Essays on financial structure and macroeconomic performance

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door

Dantao Zhu

geboren op 18 januari 1975 te Shanxi Province, China

PROMOTOR: Prof.Dr. Harry Huizinga
COPROMOTOR: Dr. Henk van Gemert

To my parents,

学而不思则罔，思而不学则殆。

—— 孔子

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Dantao Zhu
Beijing, January 29, 2006

Contents

Chapter 1

Introduction

This thesis consists of four essays examining how financial structure can affect aspects of an economy's macroeconomic performance such as economic growth, macroeconomic volatility, and consumption smoothing. The importance of financial development for economic growth has been recognized for a long time (see Schumpeter, 1912; Gurley and Shaw, 1955; Goldsmith, 1969; McKinnon, 1973; and Shaw, 1973). In the last 15 years, the literature has further developed a series of more extensive and in-depth studies on finance-growth linkages (see survey papers including Pagano, 1993; Levine, 1997; and Levine, 2004). The common understanding is that a well-functioning financial system, among all other channels, facilitates saving mobilization, enhances capital allocation efficiency, shifts portfolios towards illiquid and innovative investment, increases economic specialization, and provides a smooth payment system — all increasing economic efficiency and stimulating economic growth. Only recently, however, have researchers started to pay attention to the influences of financial development on macroeconomic performance apart from economic growth, including macroeconomic volatility, income inequality, and risk sharing. This is clearly an underexplored area of research.

Financial development is in fact multi-faceted and cannot be simply generalized. The useful concept of "financial structure" can be defined as the complex of the financial contracts, markets, institutions, the supervisory and regulatory system, the rules governing financial system functions, and the interest-rate structure. Across countries, there is no one-to-one relationship between financial structure and financial development. For example, in terms of the debt vs. equity dimension of financial structure, Japan and the U.S. have a similar level of financial development, yet quite different financial structures; Mexico and the Netherlands have similar financial structures, yet quite different degrees of financial development. Consider also the financial

structure of developing countries, compared with that of developed countries with a similar level of financial development, which is quite often characterized by the coexistence of formal and informal financial institutions. It is therefore necessary to distinguish financial structure from financial development and to study financial structure separately. In theory, the deviation from the Arrow-Debreu world due to the cost of acquiring information and making transactions creates incentives for the emergence of financial markets and institutions. It is thus the different types and combinations of information and transaction costs that motivate distinct financial contracts, markets, and institutions, giving rise to the complexity of the financial system. Thus, balanced components of a financial system are needed for an economy. It is therefore high on the agenda of economists to develop an analytical basis that describes the evolution of the financial structure and the conditions under which different financial structures are better at promoting growth, maintaining macroeconomic stability, and helping facilitate risk sharing.

The chapters in this thesis are presented as more or less independent essays in the field of financial structure and macroeconomics. Chapters 2 and 3 study the effects of the debt vs. equity dimension of the financial structure on international consumption smoothing and macroeconomic volatility, respectively. Both relationships are understudied in the current literature. Bearing in mind that informal financial institutions are prevalent in developing countries, and that policy attitudes towards these institutions are ambiguous, chapter 4 evaluates the role of informal financial institutions by examining the economic growth implications of the coexistence of formal-informal financial institutions within a specific setting of an unequal society with credit market imperfections. Chapter 5 examines interest-rate determination as the optimization choice of the central regulator, whose objective function is characterized by the regulator's ideological bias and interest groups' lobbying contributions. This set-up, enabling us to study the efficiency implications of the interest rates with political distortions, is still a relevant description of some of the transition countries. In the thesis, each of the four essays contains both a theoretical and an empirical part, varying in the relative weights. The empirical approaches differ across chapters. Chapters 2 and 3 apply cross-country regressions. Chapter 4 conducts cross-provincial regressions within one particular country. Chapter 5 carries out a country case study. Due to the theoretical relevance and to the author's own familiarity, China, both as a developing and as a transition country, has been chosen as the country to be investigated in both chapter 4 and chapter 5.

The first two chapters deal with one major dimension of financial structure, debt vs. equity, and its implications for international risk sharing and macroeconomic volatility. It is well documented that Anglo-Saxon economies

have a more market-based financial structure, and that Japan and Germany have a more bank-based financial structure. The existing literature mainly studies whether and how financial structure can affect economic growth. Levine (2002) concludes that financial structure (regarding the prominence of either debt or equity) does not help to explain long-run economic growth. He therefore takes a neutral position regarding which financial structure should be promoted. Others (Allen and Gale, 1999; and Christensen and Drejre, 1998) argue that the sources and types of growth determine which financial structure best facilitates growth. For developing countries, they argue a bank-based financial structure is preferred. Few papers, however, study the effects of the debt vs. equity dimension of financial structure on other issues of the macroeconomy, such as volatility and consumption smoothing, which are surely important concerns for macroeconomic policy makers. Sound policies promoting certain kinds of financial structure need to balance effectively various macroeconomic objectives. It is therefore necessary to understand the relationships between financial structure, on the one hand, and risk sharing and macroeconomic volatility, on the other.

Chapter 2 uses empirical proxies for the domestic development and international integration of debt and equity markets to assess the impacts of financial development and structure on international consumption smoothing. We use a simple theoretical model to illustrate how a representative consumer smoothes his consumption under a restricted availability of debt and equity market instruments due to imperfect debt and equity markets. The model yields testable implications regarding the co-movements of GDP, GDP and consumption for a given level of domestic or international debt and equity market development. These implications are then explored using a variety of empirical proxies for domestic and international debt and equity market development that are familiar from the empirical literature on the finance-growth nexus. The empirical results confirm that the extent to which consumption smoothing is possible in the face of output or GDP shocks depends importantly on the level of financial development and the type of financial structure. We find that both domestic and international aspects of financial development play distinct roles in reducing consumption variability. Domestic debt market development is more relevant, however, for reducing consumption variability relative to GNP for OECD member countries than for non-member countries. Moreover, international debt market development is more relevant for reducing consumption variability relative to GNP for non-OECD member countries than for member countries. As to the role of the financial structure on international risk sharing, we find that debt and equity have independent roles in reducing the variability of consumption relative to GDP. They are to some extent substitutes in that more of

one can make up for less of the other, consistent with the theoretical model. But it goes too far to say that financial structure doesn't matter for international consumption smoothing; calculated elasticities suggest that (within the empirical specifications of this chapter) credit market development is more potent than equity market development in reducing the variability of consumption relative to GDP.

Not only can financial development be conducive in smoothing consumption given exogenous shocks to GDP, but also financial factors themselves could be the sources of GDP volatility. *Chapter 3* constructs a simple model capturing the characteristic differences between debt and equity contracts to find a particular mechanism describing how financial structure can matter for macroeconomic volatility and economic downturns. While choosing the optimal capital structure at the firm level, the entrepreneur balances a trade-off. Debt financing is cheaper than equity financing (since debt holders need to verify fewer states), but more debt increases the probability of going into costly bankruptcy. At the aggregate level, for given negative shocks, a more bank-based financial structure leads to a higher proportion of firms going into costly bankruptcies, amplifying the unfavorable situation. The variance of GDP and the possibility and the extent of the severity of economic downturns are therefore larger in an economy with the bank-based system. Using robust standard errors, the FGLS method, and the Tobit estimation technique on a broad cross-country time series data set for various empirical specifications, this chapter indeed provides evidence that countries relying more on equity (either in absolute or in relative measures) have lower variance of GDP, and a lower possibility and less severe economic downturns. These results are interesting, given that the previous empirical studies accumulatively find mitigating effects of credit market development on volatility without accounting for equity development indicators. In this chapter, we find that when stock market capitalization is included in the regression for growth rate volatility, the credit indicators become insignificant; it is thus actually equity market development that presents a volatility-reducing role. Even more striking, regressions explaining economic downturns reveal that credit actually increases the probability and severity of economic downturns (in contrast with previous views), whereas a larger equity market remains conductive to reducing the chance and extent of downturns. Chapters 2 and 3, together with the existing literature on financial structure and economic growth, show that particular financial structures could have different directions of effects on various macroeconomic objectives. Since policy makers usually face a broader set of macroeconomic policy objectives, they quite often need to weight various macroeconomic objectives in order to set proper policies towards promoting certain kind of financial structure.

The remaining two chapters of the thesis add to the traditional finance-growth literature, but emphasize two understudied aspects of financial structure and their implications for economic efficiency and growth. One is the coexistence of formal and informal financial institutions; the other is the interest-rate structure, including interest-rate spread, loan interest-rate differences, etc. Notably, the background and mechanisms analyzed in these two chapters are more country-specific and not appropriate for economies in general. First, since informal financial institutions are especially prevalent in developing countries, the chapter studying the formal-informal financial structure is especially relevant for developing countries. Secondly, a former central-planning economy normally regulates interest rates tightly for its ideological and central-planning purposes, resulting in an interest-rate determination mechanism that is different from the regular market economy. Since even nowadays some of the transition economies are still saddled with the legacy of the central-planning system, the chapter studying interest-rate structure (assuming interest rates are set by central regulator) is more pertinent to transitional economies. Due to these two chapters studying issues with more specific backgrounds, unlike the former two chapters using cross-country empirical regressions, China, both as a developing and a transition economy, is chosen as the subject for empirical investigations in these two chapters.

Chapter 4 studies one dimension of financial structure – the coexistence of formal and informal financial institutions, and its efficiency and economic growth implications. This chapter particularly examines how, in an unequal society with information asymmetry in financial markets, the existence of informal financial institutions could be an endogenous response of the agents. The key argument is as follows. The agents differ in terms of their initial capital level. They have access to credit markets to borrow, or lend in order to invest at an optimal level. When there are information asymmetries in the credit market, the presence of limited liability of borrowers imparts a preference for risk among borrowers. This is exactly the source of moral hazard. Two types of financial institutions intermediate savings between borrowers and lenders: modern commercial banks and informal credit institutions. Banks rely on collateral in order to provide incentives for borrowers not to engage in moral hazard behaviors. Because of their proximity to the borrowers, the informal financial institutions could directly monitor the projects undertaken at a certain cost. We call it the "informal" credit market, since the model basically characterizes its features close to what is happening in reality. Given the "formal" credit market, the informal one emerges endogenously: if only a formal credit market exists, for example, then there must be some agents (characterized by the initial capital levels)

having incentives to enter into the informal credit markets. In equilibrium, the poorest segment of the agents relies on the informal market for borrowing; agents with medium wealth levels have access to the formal credit market for borrowing, but the relatively poorer segment of these medium wealth individuals are "financially constrained"; rich agents are lenders and self-finance their projects. The empirical part of this chapter uses cross-province data of China to check the relationship between initial inequality and growth. The robust negative relationship between inequality and growth is pinned down. Moreover, the policy dummy variable signalling the permission of the informal credit market presents a positive sign, which is to a certain extent consistent with the prediction of the theoretical model. The main message conveyed by chapter 4 is the following. Since both kinds of financial institutions favor or disfavor certain segments of the agents, the coexistence of the formal and informal credit institutions could combine the advantages of the two institutions, thereby enhancing efficiency and economic growth. Policymakers in developing countries should therefore be cautious when designing policy for informal financial institutions.

One particular dimension of financial structure is the interest-rate structure, which has previously been studied more often from purely economic perspectives. *Chapter 5* of this thesis takes a political economic approach to construct a lobbying model to explain positively why the interest rate could be set differently from the market-clearing level, and why the existing interest-rate structure could be a result of a political economy equilibrium. The model shows how these observations on the interest rate could follow from the choice of the regulator, who maximizes his/her social welfare objective function taking into consideration both an ideological bias toward certain sectors (in the model, it is the state-owned enterprises) and lobbying contributions. The model thus offers useful insights in explaining the depressed level of the interest rate, the size of the interest-rate spread, the interest-rate bias towards a certain sector (here, the state-owned enterprises), and the pace and sequence of interest-rate liberalization. The political distortions consequently induce welfare and efficiency deadweight losses, because, for instance, the state-owned enterprises with relatively low productivity efficiency get more than the socially optimal amount of credits. Applying this model to China for the periods between 1980 to 2004, we find that the interest groups' lobbying activity and ideological bias are forces behind the delayed Chinese interest-rate liberalization. Over time, the dynamic changes of the characteristics of interest groups and the regulator's ideology shift, together with the partial financial opening in China shaking the previous political equilibrium, can largely account for the recent trend of Chinese interest-rate liberalization and the enhancement of economic efficiency. The main

messages conveyed by this chapter are the following. First, the normative analysis of interest-rate structure based on purely economic reasons is not sufficient. Interest-rate regulation and liberalization have significant distributive effects; positive analyses using a political economy approach are thus rewarding. This is especially true for transition economies. Second, the extent to which the political economic equilibrium of interest-rate structure favors or disfavors certain players depends on the political and economic strength of the players. The underlying relative strength change can shake the previous political economic equilibrium of interest-rate structure and can contain economic efficiency implications. Third, over the past two decades, China has shown itself to be a transition economy with a central planning legacy. Her biased and low interest-rate levels, low interest-rate spread, and lagged pace and particular path of interest-rate liberalization can be explained, to a large extent, by a political economic model.

Taken together, the essays presented in the thesis collectively attempt to deepen the understanding of the determination and adaptation of the financial structure, and to widen the research scope of the impacts of financial structure on aspects of macroeconomic performance including economic growth, macroeconomic volatility, and consumption smoothing. In conveying practical messages, the thesis is offered as a tool to be used by policy-makers to set proper financial structure policies in the years to come.

Chapter 2

Domestic and International Finance: How do they Affect Consumption Smoothing?

2.1 Introduction

In tandem with the development of a range of proxies for financial market development, researchers have addressed several aspects of the financial development-growth nexus (see Levine, 1996, for an early survey). A main question is whether financial structure, i.e. the relative development of debt and equity markets, matters for growth. The answer, as suggested by Levine (2002), is that financial structure matters relatively little, as the two types of financial market development to some extent are substitutes. More recently, several papers have addressed whether there is a distinct role for international financial integration as proxied by either international capital flow or stock variables in explaining growth. The available evidence does not find clear and robust support for the idea that international financial integration boosts economic growth (see Edison, Levine, Ricci and Slok, 2002; and Prasad, Rogoff, Wei and Kose, 2003), although some studies suggest that different types of international financial integration may have different growth effects (see De Mello, 1999; and Reisen and Soto, 2001). Edison et al. (2002) particularly find that the growth effect of domestic bank or stock market development dominates that of international financial integration, if any.

Relative to the financial development-growth nexus, the link between fi-

[0]This chapter is coauthored by Harry Huizinga and it first appeared as "Domestic and International Finance: How do they Affect Consumption Smoothing?", *CEPR working paper* 4677 (Huizinga and Zhu, 2004).

nancial development and consumption smoothing has received little attention in the empirical literature. Theoretical contributions (see Obstfeld and Rogoff, 1998, Chapter 5; Sorensen and Yosha, 1998; and Baxter and Crucini, 1995) have laid out that the feasibility of international consumption smoothing depends crucially on the existence and tradeability of debt and equity instruments. The tradeability of equity, specifically, should allow economies to swap equity shares, or claims to output as proxied by GDP, with the result of smoothing both national income, or GNP, and consumption. The tradeability of debt claims, in turn, enables economies to adjust their consumption streams in the face of temporary output shocks that remain despite equity trading. Debt and equity market development hence are expected to be empirically important in explaining the variability of consumption smoothing across countries. The purpose of this chapter is to provide a detailed empirical investigation of how in fact financial market development affects the ability to smooth consumption at the national level. A range of empirical proxies for debt and equity market development and efficiency, familiar from the growth literature, are used for this purpose.

Private agents, with few exceptions, only deal with domestic banks and other financial institutions. If so, international consumption smoothing can only come about through the international interaction of financial institutions. Banks, for instance, may choose to offset their aggregate transactions with their domestic retail customers by entering the international interbank deposit market. Similarly, domestic equity market institutions (brokerage houses, exchanges, clearing and settlement institutions) generally are involved in any transaction that changes a country's portfolio equity balance. This suggests that both domestic financial market development and financial market integration are necessary to bring about effective international consumption smoothing. Parallel to the finance and growth literature, this chapter tests for the independent effects of both aspects of overall financial development. International financial market integration is measured by several gross or net debt and equity balances from the capital account of the balance of payments and, alternatively, by dummy variables indicating whether a particular net balance item is positive.

In overall economic development, domestic financial development can be expected to precede international financial integration. The reason is that international financial integration, mostly resulting from the international interaction of financial institutions, presupposes the existence of these (domestic) financial institutions. The existence of an international interbank deposit market, for instance, requires the existence of banking institutions that are active in individual countries. This suggests that for countries just entering international financial markets the bottleneck factor will indeed be

the level of international integration of domestically active financial institutions. At higher levels of economic development, there already is some level of international financial integration and, relatively speaking, domestic financial market development becomes more of a bottleneck factor. To see why this is the case, note that even in rich countries a high percentage of households does not have substantial financial assets and only a limited borrowing capacity. Hence, even in rich countries many households can do little to contribute to their own consumption smoothing. For these individuals, there thus can only be international consumption smoothing through their "participation" in national tax and transfer systems. This suggests that for rich economies the bottleneck in bringing about better international consumption smoothing will be domestic financial development. Our sample includes developed and developing countries. This allows us to test whether different aspects of financial development are important for countries at different levels of economic development in furthering international consumption smoothing.

As indicated, on the basis of the theory we expect equity market development to help smooth GNP relatively to GDP. Debt market development subsequently helps to smooth consumption relative to GNP, while debt and equity market development together contribute to smoothing consumption relative to GDP. Based on these three relationships, the chapter presents three sets of empirical results.

Regarding the first relationship, we find that proxies for domestic equity market development, in particular the ratio of stock market capitalization to GDP and stock market turnover, are important in smoothing GNP relative to GDP for the overall world sample. However, we find no role for our measures of international equity market integration, in particular gross and net stocks of FDI and portfolio equity investments, to explain GNP smoothing. The bottleneck factor thus appears to be domestic equity market development, as this explains differences in GNP variability relatively well in the world sample. Domestic equity market development has a similar role in reducing GNP variability for developed and developing countries separately. The role of international financial market integration, as measured by FDI stocks, however, is different for the two sets of countries. FDI exposure appears to contribute to GNP smoothing for developing countries, but it perversely increases GNP variability for developed countries. This may reflect that the FDI flows of rich countries are intended to capitalize on these countries' technological and other strengths and in practice are bad hedges against output shocks.

Our proxies for domestic debt market development, i.e. measures of bank credit and overall liquid assets relative to GDP and the bank interest spread, and our proxies for international debt market integration, i.e. gross and net

stocks of bank intermediated debts and other debt instruments, all perform well in explaining the smoothing of consumption relative to GNP. Interestingly, domestic debt market integration is found to be more important in smoothing consumption for developed countries, and vice versa. This suggests that for developed countries, with well-established international links between financial institutions, domestic debt market integration is the bottleneck factor.

Finally, we examine the joint role of debt and equity market development in explaining consumption smoothing in the face of GDP shocks. For this purpose, domestic debt market development is measured by bank credit relative to GDP, while domestic equity market development is measured by the stock market capitalization relative to GDP. International debt and equity market integration now are measured as gross debt and equity balances relative to GDP. We find that debt and equity market development have an independent role in explaining consumption smoothing. In fact, debt and equity market development appear to be substitutes in that a lack of one can be made up by more of the other. Moreover, the effectiveness of, say, debt market development to smooth consumption relative to GDP decreases in the extent of equity market development, and vice versa. On the basis of the estimated coefficients, we can compute the implied elasticities of the variability of consumption with respect to debt and equity market development. Comparing these elasticities, we see a larger role for debt markets in smoothing consumption than for equity markets. Domestic debt market development continues to be relatively important for developed countries.

In previous work, Van Wincoop (1994) has shown that international risk sharing can bring non-negligible welfare gains. Asdrubali, Sorensen and Yosha (1996) use a decomposition of variance to compute the relative importance of equity market development (which smooths GNP relative to GDP) and debt market development (which smooths consumption relative to GNP). Sorensen, Wu, and Yosha (2002) show that risk sharing from international cross-ownership of assets, as measured by the smoothing of GNP, is higher in countries that hold a higher amount of foreign equity relative to GDP. Bekaert, Harvey, and Lundblad (2002) find that capital account openness has smaller effects on consumption smoothing than equity market liberalization. Melitz and Zumer (1999) show that in the long run credit plays a smaller role relative to claims on property in risk sharing between countries. Becker and Hoffmann (2003) extend Asdrubali et al. (1996) to a dynamic setting and find that transitory shocks can be smoothed away to a greater extent than permanent shocks because market incompleteness may render permanent shocks a lot harder to insure. Kose, Prasad, and Terrones (2003) show that the risk-sharing and consumption smoothing benefits of financial

integration appear to accrue only beyond a certain "threshold" level of financial openness. Easterly, Islam, and Stiglitz (2001) find that a higher level of development of the domestic financial sector is associated with lower output volatility. However, their concern is how domestic financial development can affect output volatility rather than consumption smoothing. Relative to these papers, the contribution of this chapter is to examine simultaneously the domestic and international aspects of debt and equity market development in bringing about consumption smoothing.

The next section presents the underlying theoretical model. Section 2.3 describes the data and empirical specifications. Section 2.4 presents and interprets the empirical results. The final section concludes.

2.2 The model

This section lays out the theoretical framework that underlies the later empirical work. There is a representative agent who adjusts his consumption path in the face of domestic output shocks subject to financial market imperfections. Both debt and equity markets exist, but market imperfections imply that the agent can only smooth consumption partially through the use of debt and equity instruments.

2.2.1 Assumptions

At the beginning of period $t = 1, 2, ...$, the representative agent receives a random output, denoted GDP_t, generated from a "goods tree". This output is the sum of a fixed value $\bar{y}$ and a random component ε_t as follows

$$GDP_t = \bar{y} + \varepsilon_t \tag{2.1}$$

The temporary random shock $\{\varepsilon_t : t = 1, 2, ...\}$ is an i.i.d. sequence with $E(\varepsilon_t) = 0$ and $Var(\varepsilon_t) = \sigma^2$[1].

The representative individual chooses the optimal consumption level c_t at the beginning of each period t to maximize the expected value of lifetime utility given by,

$$U_t = E_t \left\{ \sum_{\tau=t}^{\infty} \beta^{\tau-t} u(c_\tau) \right\} \tag{2.2}$$

[1] Our framework abstracts from the distinction between temporary and permanent shocks considered in Becker and Hoffman (2003).

where β is a discount factor taken to be equal to $\frac{1}{1+r}$ with r being the international interest rate. Further, we take the utility function to be quadratic with $u(c) = c - \frac{a_0}{2}c^2$.

In principle, both equity and debt markets are available to enable the consumer to smooth his consumption path. Equity markets allow the individual to diversify away part of the risk associated with domestic output by selling shares to foreigners (in exchange for riskless foreign debt instruments or a diversified, riskless foreign share portfolio). After the shock is known, the individual may wish to borrow or lend internationally to the extent that he has not already diversified away the risk associated with domestic output. Market imperfections are assumed to limit in practice the extent to which the individual can transact in international equity and debt markets. Straightforwardly, the individual would like to sell all the equity in the domestic goods tree to obtain perfect income certainty. In practice, we assume that only a share α_s $(0 \leqq \alpha_s \leqq 1)$ of desired (total) equity sales can be realized. Similarly, we will assume that only a share α_c $(0 \leqq \alpha_c \leqq 1)$ of the desired borrowing or lending (after the shock is known) can be realized. Desired lending or borrowing is below shown to be a simple share of the output shock (with imperfect equity markets). Rather than as a share of desired lending or borrowing, the limitation on borrowing could thus easily be rephrased as a share of the observable output shock.

The literature has advanced several reasons why perfect risk sharing through equity and debt markets, domestic or international, in reality is not possible (see Lewis, 1999, for a survey). These include, among others, contract writing costs (Levine, 1997), the non-tradeability of goods (Tesar, 1993), the existence of non-tradeable wealth such as human capital (Lewis, 1999), restrictions on the ownership of foreign assets that can take the form of taxes on repatriated earnings (Lewis, 1996), asymmetric information regarding the productivity of assets (Brennan and Cao, 1997), incomplete markets due to imperfect contract enforcement (Kehoe and Perri, 2002), and the incentive effects associated with selling equity to outside international investors (Eijffinger and Wagner, 2001). Factors of this kind limit domestic financial market development as well as international financial integration and, indirectly, a country's ability to smooth consumption through international debt and equity markets. In this chapter, we do not spell out the precise micro foundations of the restriction parameters α_s and α_c. In the subsequent empirical work, however, we will take empirical proxies for equity and debt market development and international integration also to be proxies for the equity and debt transaction restriction parameters.

2.2.2 Optimal consumption under financial market constraints

With actual equity sales to foreigners equal to the maximum possible, it is seen that domestic national income, or GNP, is given by

$$GNP_t = rA_{t-1} + \bar{y} + (1-\alpha_s)\varepsilon_t \tag{2.3}$$

where A_{t-1} is the country's net foreign asset position at the beginning of period t before any equity trading[2].

Taking into account equity market diversification, we can write the consumer's post-diversification intertemporal budget constraint at period t as follows,

$$E_t\left\{\sum_{\tau=t}^{\infty}(\frac{1}{1+r})^{\tau-t}c_\tau\right\} = (1+r)A_{t-1} + E_t\left\{\sum_{\tau=t}^{\infty}(\frac{1}{1+r})^{\tau-t}(\bar{y}+(1-\alpha_s)\varepsilon_\tau)\right\} \tag{2.4}$$

The consumer determines his consumption - and implicitly his international borrowing and lending - so as to maximize lifetime utility subject to the post-diversification intertemporal budget constraint. This yields the following familiar Euler equation,

$$E_t\left\{u'(c_s)\right\} = (1+r)\beta E_t\left\{u'(c_{s+1})\right\} \tag{2.5}$$

for $s >= t$. This implies $c_t = E_t c_s$ for $s > t$, as $(1+r)\beta = 1$. Recognizing the budget constraint, we can now derive the optimal consumption, c_t^*, if there were no debt market imperfection or $c_t^* = \bar{y} + rA_{t-1} + \frac{r}{1+r}(1-\alpha_s)\varepsilon_t$. Correspondingly, we can derive the optimal lending (or borrowing, if negative) in the absence of debt market restrictions, L_t^*, given by $L_t^* = \frac{1}{1+r}(1-\alpha_s)\varepsilon_t$.

As only a fraction α_c of these desired credit market transactions can be realized, we see that actual lending (or borrowing) L_t is given by

$$L_t = \frac{1}{1+r}\alpha_c(1-\alpha_s)\varepsilon_t \tag{2.6}$$

So the actual consumption, c_t, different from desired consumption, c_t^*, can be seen to be given by

$$c_t = rA_{t-1} + \bar{y} + (1-\alpha_s)\varepsilon_t - L_t = rA_{t-1} + \bar{y} + (1-\alpha_c\frac{1}{1+r})(1-\alpha_s)\varepsilon_t \tag{2.7}$$

[2]Note that GNP ignores capital gains or losses on the net foreign asset position as discussed by Obstfeld (2004).

The dynamics of GNP, consumption and the net foreign asset position can now be derived as follows

$$GNP_t - GNP_{t-1} = (1-\alpha_s)[\varepsilon_t - (1 - \frac{r}{1+r}\alpha_c)\varepsilon_{t-1}] \tag{2.8}$$

$$c_t - c_{t-1} = (1-\alpha_s)[(1 - \frac{\alpha_c}{1+r})\varepsilon_t - (1-\alpha_c)\varepsilon_{t-1}] \tag{2.9}$$

$$A_t - A_{t-1} = \frac{1}{1+r}\alpha_c(1-\alpha_s)\varepsilon_t \tag{2.10}$$

These variables in first difference are seen to be stationary.

2.2.3 Derivation of estimating equations

In this subsection, we derive the estimating equations that relate the co-variability of GDP, GNP and consumption to empirical proxies of domestic financial development and international financial integration. To start, the three covariances among GDP_t and GNP_t, GNP_t and c_t, and GDP_t and c_t - all in first differences - can be obtained as follows,

$$Cov(GDP_t - GDP_{t-1}, GNP_t - GNP_{t-1}) = (1-\alpha_s)(2 - \frac{r}{1+r}\alpha_c)\sigma^2$$

$$Cov(GNP_t - GNP_{t-1}, c_t - c_{t-1}) = (1-\alpha_s)^2[2(1-\alpha_c) + \frac{r}{1+r}\alpha_c^2]\sigma^2$$

$$Cov(GDP_t - GDP_{t-1}, c_t - c_{t-1}) = (1-\alpha_s)^2[2 - (\frac{2+r}{1+r})\alpha_c]\sigma^2$$

Next, we can derive the following theoretical least-squares regression equations:

$$GNP_t - GNP_{t-1} = b_1(GDP_t - GDP_{t-1}) \tag{2.11}$$

$$c_t - c_{t-1} = b_2(GNP_t - GNP_{t-1}) \tag{2.12}$$

$$c_t - c_{t-1} = b_3(GDP_t - GDP_{t-1}) \tag{2.13}$$

with the three coefficients b_1, b_2 and b_3 given by,

$$b_1 = \frac{Cov(GDP_t - GDP_{t-1}, GNP_t - GNP_{t-1})}{Var(GDP_t - GDP_{t-1})} = (1-\alpha_s)(1 - \frac{r}{2+2r}\alpha_c)$$

$$b_2 = \frac{Cov(GNP_t - GNP_{t-1}, c_t - c_{t-1})}{Var(GNP_t - GNP_{t-1})} = \frac{2(1-\alpha_c) + \frac{r}{1+r}\alpha_c^2}{1 + (1 - \frac{r}{1+r}\alpha_c)^2}$$

$$b_3 = \frac{Cov(GDP_t - GDP_{t-1}, c_t - c_{t-1})}{Var(GDP_t - GDP_{t-1})} = (1-\alpha_s)(1 - \frac{2+r}{2+2r}\alpha_c)$$

To interpret the coefficients, first note that b_1, b_2 and b_3 all depend on the interest rate r. To see why, note that a higher interest r increases the return to savings out of GNP_{t-1}, thereby making GNP_t more responsive to ε_{t-1}. This reduces the co-variation between differenced GNP and differenced GDP as well as b_1. At the same time, we see that lending L_t is negatively related to the interest rate r in (2.6) (as at a higher interest rate smaller savings are required to guarantee a higher level of consumption in the future). At a higher interest rate, actual lending thus becomes less responsive to the output shock ε_t and at the same time consumption becomes more responsive to this shock. This increases the covariances between the differenced consumption and GNP, and between the differenced consumption and GDP - leading to higher coefficients b_2 and b_3. The role of the interest rate in this model, to wit, reflects its discrete-time nature, with only periodic adjustment of consumption to output shocks. With smaller periods, the relevant interest rate between periods would become smaller as well. If we let the interest rate go to zero, it can be seen that b_1 collapses to $1 - \alpha_s$, that b_2 collapses to $1 - \alpha_c$, and that b_3 collapses to $(1 - \alpha_c)(1 - \alpha_s)$. Regardless of whether the interest rate is taken to be zero in the limit, the role of the restriction parameters α_s and α_c in determining b_1, b_2 and b_3 is now apparent. A less stringent equity market restriction - or higher α_s - reduces the "regression coefficient" b_1, while a less stringent debt market restriction - or higher α_c - reduces the "regression coefficient" b_2. Finally, higher values of α_s and α_c both reduce b_3 and we see that $\frac{\partial^2 b_3}{\partial \alpha_s \partial \alpha_c} = \frac{2+r}{2+2r} > 0$, which means that - with a higher level of the equity market restriction parameter - the effect of a higher debt market restriction parameter in reducing the covariance between consumption and GDP is smaller (and vice versa).

Next, we note that the restriction parameters α_s and α_c are not directly observable. However, we can assume that they are related to observable measures for equity and credit market development, denoted S and C, by $\alpha_s = \beta_s S$ and $\alpha_c = \beta_c C$. The restriction parameters α_s and α_c can change over time, as S and C vary over time. Substituting period t values for α_c and α_s and suppressing the interest rate, we get

$$GNP_t - GNP_{t-1} = GDP_t - GDP_{t-1} - \beta_s S_t (GDP_t - GDP_{t-1}) \qquad (2.14)$$

$$c_t - c_{t-1} = GNP_t - GNP_{t-1} - \beta_c C_t (GNP_t - GNP_{t-1}) \tag{2.15}$$

$$c_t - c_{t-1} = GDP_t - GDP_{t-1} - \beta_c C_t (GDP_t - GDP_{t-1}) - \beta_s S_t (GDP_t - GDP_{t-1}) + \\ + \beta_c \beta_s C_t S_t (GDP_t - GDP_{t-1}) \tag{2.16}$$

After adding a constant and error terms, we obtain the benchmark regression equations underlying the empirical work in the next section. A variety of proxies for domestic equity market development and international equity market integration will be used for S_t, while a variety of domestic and international debt market indicators will be used to represent C_t. In the empirical work, growth rates rather than first differences of the GDP, GNP and consumption variables will be used.

2.3 Data and empirical specifications

2.3.1 Data

The data on GDP, GNP, consumption and domestic financial development cover 210 countries from 1960 to 2001, while there are international financial variables for 67 countries during 1970-1998. This section briefly describes the data used in this study. Variable definitions and data sources are provided in appendix.

2.3.2 Macroeconomic and domestic financial variables

GDPg, GNPg, CONSg are defined as the annual growth rates of per capita GDP, GNP, and final consumption expressed in terms of constant local currencies[3]. Domestic financial variables are proxies for domestic debt and equity market development. Two stock market development indicators are used as measures of domestic stock market size and efficiency. They are the market capitalization of listed companies as a percent of GDP *(MCap)* and stock market turnover relative to market capitalization *(Turn)*. There are five domestic credit market development indicators: domestic credit to the private sector as a percent of GDP *(CredPriv)*, domestic credit provided by the banking sector as a percent of GDP *(CredBank)*, liquid liabilities as a percent of

[3]Local currencies are chosen since we are interested in countries' growth rates rather than international level comparisons.

GDP *(M3)*, and the bank interest rate spread *(Spread)*. They characterize the size (*CredPriv, CredBank*), liquidity (*M3*) and efficiency (*Spread*) of the domestic credit market.

2.3.3 International financial variables

The international financial variables are indices of international equity and debt market integration. All of these variables are based on financial stock variables from the balance of payments. Stock variables summarize a country's past involvement in international financial markets and are taken to be indices of potential current international financial activity in pursuit of consumption smoothing as well. To represent international equity integration, there are three variables: the gross stock of foreign direct investment assets and liabilities as a percent of GDP (*FDI*), the gross stock of the portfolio equity assets and liabilities as a percent of GDP (*PortEq*), and the sum of the previous two, i.e. the gross international equity stock as a percent of GDP (*TotEq*). These variables are obtained from estimates by Lane and Milesi-Ferretti (2001).

To obtain variables to represent international debt market integration, we need to use data from several sources. Again represented as the sums of national assets and liabilities, i.e. as gross variables, we have three variables for rich countries: gross non-portfolio debt (mostly bank debt) as a percent of GDP *(IntBank)*, gross portfolio debt as a percent of GDP *(PortDebt)*, and, finally, the sum of the previous two, i.e., gross total debt as a percent of GDP *(TotDebt)*. For poor countries, we can obtain two analogues of the rich-country *TotDebt* by taking the sum between one series of national debt liability[4] (from the OECD) and two alternative estimated series of debt assets (Lane and Milesi-Ferretti, 2001), leading to the *TotDebt* and *TotDebt*$'$ series for poor countries. After combining with rich-country data, we obtain the *TotDebt* and *TotDebt*$'$ series for the world as a whole.

Gross stock variables are indices of total market activity. Higher gross stocks thus may give rise to volume-based, lower transaction costs in international financial markets, which would be a sign of higher financial market integration. Gross stock variables, by construction, give equal weight to national financial assets and liabilities. However, it is reasonable to assume that

[4]For debt liability data, we in fact have two measures avaliable, constructed differently. OECD data rely mainly on the creditor-reporting system and refers primarily to debt by a country's residents, regardless of the currency of denomination. World Bank data relies on a debtor-reporting system and focuses primarily on foreign-currency denominated debt. Not surprisingly, the World Bank numbers are smaller than OECD numbers. We use the broader OECD data as out debt liability measure.

countries with a positive net foreign asset position in, say, bank deposits can more easily smooth their consumption than countries with a negative net asset position, as it may be easier to draw down positive balances than to increase negative balances. To reflect this, we also construct analogous net stock variables, measured as national assets minus liabilities for the relevant financial instrument category. These net stock variables clearly are continuous variables. However, it may be important whether a country is a net asset or liability holder rather than how large these net assets or liabilities are. To reflect this, we also construct net stock dummy variables that take on a value of 1 if the country is a net asset holder in a particular instrument category and zero otherwise.

2.3.4 Summary statistics

Table 2.1 provides summary statistics for all the variables. Next, Table 2.2A gives the correlation coefficients among the *GDPg, GNPg, CONSg* variables. It is seen that the correlation coefficients between *GDPg* and *GNPg* are close to one. The correlation coefficients between *GDPg* and *GNPg* on the one hand and *CONSg* on the other are both shown to be a bit above 0.5. Table 2.2B gives the correlation coefficients among the financial variables, with the international financial variables measured in gross stock terms. The financial variables tend to be significantly correlated with the expected signs. Countries with large domestic debt markets (high *CredPriv* and *CredBank*), for instance, tend to have highly liquid financial markets (high *M3* and *M3_M1*) and a high efficiency (low *Spread*). Turning to the international equity variables, we see that countries with high gross FDI stocks also tend to have high gross portfolio equity stocks, which suggests that these modes of equity finance are complements rather than substitutes. Not surprisingly, the two total international debt measures (*TotDebt* and *TotDebt'*) are highly positively correlated with a correlation coefficient of 0.923. We see, however, that the *TotEq* and *TotDebt* variables display a weak negative correlation, while *TotEq* and *TotDebt'* display only a weak positive relation. Also note that the domestic debt variables tend to be positively correlated with the international debt variables and the same holds for the equity variables. Domestic and international financial development, not surprisingly, thus tend to move in tandem.

2.4 Empirical results

This section presents three sets of regression results. First, we examine how equity market development affects the co-movement of GNP and GDP based on specification (2.14). Second, we consider how debt market development affects the co-movement of consumption and GNP based on specification (2.15). Finally, the impact of equity and debt market development on the co-movement of consumption and GDP is considered along the lines of specification (2.16). For all three sets of regressions as discussed in three subsections, we first take the worldwide sample and subsequently the samples of OECD and non-OECD countries separately. For each sample, the impact of domestic and international financial variables is considered in turn given that these tend to be substantially positively correlated as seen in Table 2.2B. Subsection 2.4.2 in addition considers the joint impact of domestic and international debt market development on the relationship between consumption and GNP to check whether in fact they can be shown to have a distinct impact. Subsection 2.4.4, finally, assesses the quantitative impact of domestic and international finance on the co-movements of GDP, GNP and consumption as implied by the estimated regression coefficients.

Throughout, we correct for possible heteroscedasticity across country panels and autocorrelation over time within a panel. Specifically, we allow for AR(1) autocorrelation which is specific for each country in the panel data set, while between countries we assume heteroskedasticy[5]. Estimation is by feasible generalized least squares (FGLS).

2.4.1 Smoothing GNP relative to GDP

The regressions of GNP growth on GDP growth are based on specification (2.14). Table 2.3 shows the results for the worldwide sample. Panel A is based on domestic equity market variables, while Panels B through D contain the international equity market variables in gross, net and dummy form, respectively. In Table 2.3A, stock market capitalization and turnover ratio enter the regressions separately with negative and significant coefficients, which suggests that both domestic stock market size and efficiency are conducive to smoothing GNP relative to GDP. Moreover, capitalization and

[5]We do not specify cross-sectional correlation because in order to consider this possibility we must have at least as many time periods as there are panels in the dataset, which is not the case. We attentively applied robust standard error methods with clustering of countries, which specifies that error terms are independent across countries but correlated within a country with similar, unreported results.

stock market turnover jointly enter into a regression with negative signs as well, demonstrating to some extent that stock market size and efficiency actually play distinct roles. In Tables 2.3B through 2.3D, international equity market integration indicators - in gross, net, and dummy forms - appear to be unimportant for the smoothing of GNP relatively to GDP with the exception that the net dummy variable for equity (*TotEq*) enters negatively, to suggest that a positive net equity positive position is good for smoothing GNP relative to GDP.

Table 2.4 presents results analogous to Table 2.3 but based on a sample of only OECD member countries[6]. Domestic stock market size and efficiency play similar roles in Table 2.4A for OECD countries as for the world as a whole. Turning to the international variables, we see that gross *FDI* and *PortEq* enter simultaneously with a negative and positive coefficients in Table 2.4B. In net and dummy forms, the international equity variables enter with positive significant coefficients in several instances in Tables 2.4C and 2.4D. Overall, this suggests that equity investments of rich countries do not contribute to smoothing GNP relative to GDP. This is consistent with Lane (2001) who finds that cross-holdings of foreign assets and liabilities more broadly fail to smooth GNP relative to GDP for OECD countries. These finding could reflect that in practice international equity investments from rich countries serve to exploit national technological and other advantages, while international equity portfolio diversification may only be of secondary importance in the selection of international portfolio investments.

For the non-OECD countries in Table 2.5, the domestic equity variables, i.e. stock market capitalization and turnover, play a similar role in smoothing GNP relative to GDP as in the world sample, as both variables enter the regressions in Table 2.5A with negative and significant coefficients. Similarly to the world sample, international equity market integration indicators, measured in gross terms, do no appear to significantly reduce GNP shocks relative to GDP shocks. However, when measured in net and dummy terms, higher FDI appears to contribute to GDP smoothing for the poor countries in Tables 2.5C and 2.5D. For non-OECD countries, FDI thus appears to bring diversification advantages, as the implied activities (in part resulting from inward FDI) may be sufficiently distinct from domestic activities (not related to FDI).

[6]We use the latest OECD member country list including the following 30 countries: Australia, Austria, Belgium, Canada, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Japan, Korea, Rep., Luxembourg, Mexico, Netherlands, New Zealand, Norway, Poland, Portugal, Slovak Republic, Spain, Sweden, Switzerland, Turkey, United Kingdom, United States.

2.4.2 Smoothing consumption relative to GNP

In this subsection, we present regressions of consumption growth on GNP growth along the line of (2.15). Table 2.6 presents the results for the world as a whole. In Table 2.6A, the various domestic debt market development indicators enter into regressions of consumption growth on GNP growth with negative and significant coefficients, except for the interest rate spread which enters with a positive but not statistically significant coefficient. So larger domestic debt markets (measured by higher *CredPriv* and *CredBank*) and more liquid ones (higher *M3*) appear to contribute to smoothing consumption relatively to GNP. Turning to the international debt indicators *TotDebt and* $TotDebt^{'}$, we see in Tables 2.6B through 2.6D that they enter negatively regardless of whether they are in gross, net or dummy form, with statistically significant coefficients (apart from the net *TotDebt* variable). Specifically, the negative and significant signs for the *TotDebt* and $TotDebt^{'}$ variables in dummy form suggest that countries with positive net foreign debt assets can more easily smooth their consumption in the face of GNP shocks than countries with negative net foreign debt assets. This makes sense as it should be much easier to draw down a positive bank deposit balance or to liquidate a net position in bonds than to borrow money from banks or through the flotation of bonds in the international capital market. Specifically, the liquidation of positive debt balances may be quicker and require lower transaction costs[7].

Table 2.7 presents the results for OECD countries. Now in Table 2.7A, all domestic debt market variables enter the regressions with significant coefficients, with the expected negative signs for *CredPriv, CredBank,* and *M3,* and a positive sign for *Spread.* For rich countries, domestic debt market development thus is important in explaining international variation in the smoothing of consumption relative to GNP. Turning to the international debt variables, we now have the *CredPriv, CredBank* variables in addition to a *TotDebt* variable. For the gross variables, we see that all three enter with negative and significant coefficients in Table 2.7B when entered by themselves. Negative coefficients also are shown in several instances in Tables 2.7C and 2.7D with the net and dummy variables. For OECD countries, international debt integration thus appears to make a contribution to the smoothing of consumption to GNP as well.

Next, for non-OECD countries in Table 2.8 all of the domestic debt mar-

[7]Note that transaction costs may imply that the net-of-cost interest rate received on positive debt balances is less than the cost-inclusive interest rate to be paid on negative debt balances. This could lead to a more rapid liquidation of positive balances than build-up of negative balances, but the oppositive should be true as well.

ket development again enter with negative coefficients, apart from *Spread* that enters with a positive coefficient. Two of these variables *CredBank* and *M3*, however, fail to have coefficients that are statistically significant. Thus the evidence that domestic debt market development matters for non-OECD countries is somewhat weaker than it is for OECD countries. Turning to the international variables *TotDebt* and *TotDebt'*, we see that these enter with negative and significant coefficients in Tables 2.8B through 2.8D. Hence, the evidence that international debt market integration is important for smoothing consumption relative to GNP is particularly strong for poor countries.

Finally, it is interesting to include both domestic and international debt variables in the regression to examine their relative importance in smoothing consumption relative to GNP. Analogous to (2.13), we can assume that domestic agents consecutively have to overcome domestic and international credit market barriers to smooth consumption relative to GNP. In (2.12), this means that we can take b_2 to equal $(1-\alpha_{cd})(1-\alpha_{ci})$ where α_{cd} and α_{ci} are domestic and international debt market restriction parameters respectively (again for an interest rate of zero). Instead of (2.15), we now get

$$c_t - c_{t-1} = GNP_t - GNP_{t-1} - \beta_{cd} C_{d,t}(GNP_t - GNP_{t-1}) - \beta_{ci} C_{i,t}(GNP_t - GNP_{t-1})$$

$$+\beta_{cd}\beta_{ci} C_{d,t} C_{i,t}(GNP_t - GNP_{t-1}) \qquad (2.17)$$

where $C_{d,t}$ and $C_{i,t}$ are domestic and international debt variables, respectively. In (2.17), the interaction term of the domestic and international debt variables enters positively to reflect that more domestic debt market development reduces the marginal benefit of international debt market integration in consumption smoothing, and vice versa. To implement (2.17), we take the domestic debt variable to be either *CredPriv* or *CredBank* and the international debt variable to be either *TotDebt* or *TotDebt'*.

In Table 2.9, regressions (1) and (2) relate to the sample of OECD countries, while regressions (3) through (6) relate to the non-OECD countries. We see that (i) the domestic debt variables enter regressions (1) and (2) for the OECD sample with negative coefficients with significance levels of at least 10 percent, but not so in regressions (3) through (6) for the non-OECD sample, and (ii) the international debt variables obtain negative coefficients in regressions (3) through (6) for the non-OECD sample with significance levels of at least 10 percent, but not so in regressions (1) and (2) for the OECD sample. This suggests that domestic debt market development (international debt integration) is a relatively important bottleneck in improving the smoothing of consumption relative to GNP in OECD (non-OECD) countries. This may

reflect that poor countries still have rather weak links with the international debt market, and hence improving these links may be most important in achieving better consumption smoothing. For rich countries, links with the international debt market are generally well-established. In these countries, however, there are still many households that may not have sufficient financial wealth or may otherwise not be sufficiently "plugged into" the financial system to enable them to smooth their household consumption. In rich countries, further domestic financial development may serve to increase the share of households that can effectively smooth their household consumption and hence improve overall macroeconomic consumption smoothing. Finally, note that the debt variables interaction terms enter with positive coefficients in all regressions of Table 2.9, even if the interaction term is only significant (at the 5 percent level) in regression 3. This provides some evidence that the (marginal) benefit of higher domestic debt market development in improving consumption smoothing decreases with the level of international debt market development, and vice versa, consistent with (2.17).

2.4.3 Smoothing consumption relative to GDP

Next we present the results of regressions relating consumption growth to GDP growth following (2.16) to see how equity and debt market development jointly affect the smoothing of consumption relative to GDP. For this purpose, we select *CredPriv* and *CredBank* to be two alternative domestic debt market variables, while *MCap* is the domestic equity market variable. At the same time, we select *TotDebt* and *TotDebt'* to be alternative international debt market variables and *TotEq* to be the international equity market variable.

Table 2.10 presents the results for the world sample. The two domestic debt variables and the capitalization variable enter with negative and significant coefficients in the two regressions, which indicates that debt and equity market development have distinct roles in bringing about consumption smoothing as suggested by the theoretical model of section 2.2. Interestingly, the interaction terms of *CredPriv* or *CredBank* with *MCap* enter the two regressions positively and significantly at the 10 and 5 percent respectively, also consistent with the theoretical model. The (marginal) benefit of higher debt market development in improving consumption smoothing thus decreases with the level of equity market development, and vice versa. The marginal benefit of either type of development, however, remains positive (see the next subsection for an assessment of the implied quantitative effects), which suggests that domestic debt and equity market are substitutes in that a relative lack of one can be made up by having more of the other.

It would be going too far, however, to say that financial structure (or the relative development of debt and equity markets) does not matter, as the marginal effects of the two types of development are not the same (see again the next subsection for a quantitative assessment). For the international variables in the world sample, we get qualitatively similar results for the gross, net, or net dummy measures of both the *TotDebt* and *TotDebt'* variables with several of the regression coefficients having the expected signs and being statistically significant.

Table 2.11 presents the results for the OECD sample. In Table 2.11A, for domestic debt and equity variables we get similar results for the OECD sample as for the whole world as a whole. Interaction terms are positive and significant. For the international financial variables, the gross variables regressions in Table 2.11B are consistent with our model, while Tables 2.11C and 2.11D provide somewhat less strong support for the model using net and dummy variables. Overall, however, Table 2.11 suggests that international equity market integration leads to better consumption smoothing after we control for international debt market integration. This result is more in line with expectations based on the theory than those reported in subsection 2.4.1 which suggested that for OECD countries international equity market integration can amplify rather than reduce shocks of GNP relative to GDP.

Finally, Table 2.12 presents the results for non-OECD countries. Again, the domestic debt and stock market capitalization variables and their interactions enter with the expected signs and are significant at minimally the 10 percent level. In Table 2.12B, the international financial variables in gross terms also enter with expected and significant coefficients (in the second regression). The regressions reported in Tables 2.12C and 2.12D, however, provide less strong support for the theory: in Table 2.12C only the *TotDebt'* variables has a negative and significant coefficient according to the theory, while in Table 2.12D the interaction term of *TotDebt'* and *TotEq* has an unexpected negative and significant coefficient.

Overall, the results in this section strongly support the theoretical predications that (i) both equity and debt market development are useful in reducing the co-movement of consumption and GDP and that (ii) the marginal benefit of having one type of financial market development decreases in the level of the other type.

2.4.4 Quantitative assessment

Next, we wish to assess the quantitative importance of the estimated coefficients of the previously reported regressions for reducing the variability of consumption and GNP relative to each other and relative to GDP. To start,

we wish to know how the estimated coefficients on the stock market variables in the regressions reported in Tables 2.3 through 2.5 can be used to compute the implied elasticities of the variance of GNP growth (as a ratio of the variance of GDP growth). Extending the theoretical framework, we can easily derive that the ratio of the variance of (differenced) GNP to (differenced) GDP is related to the equity trading restriction parameter α_s as follows,

$$\frac{var(GNP_t - GNP_{t-1})}{var(GDP_t - GDP_{t-1})} = (1 - \alpha_s)^2$$

where we take the interest rate r to be zero.

The elasticity of this relative variance w.r.t. α_s is now seen to be given by[8]

$$\zeta_1 = \frac{\partial}{\partial \alpha_s}\left(\frac{var(GNP_t - GNP_{t-1})}{var(GDP_t - GDP_{t-1})}\right) \bullet \frac{\alpha_s}{\frac{var(GNP_t - GNP_{t-1})}{var(GDP_t - GDP_{t-1})}} = \frac{-2\alpha_s}{1 - \alpha_s} \qquad (2.18)$$

Remember that $\alpha_s = \beta_s S$ where S stands for overall (domestic or international) stock market development. To evaluate expression (2.18) we can take an estimated value for the coefficient β_s from one of the tables with regression results and find an associated value for S by taking the sample mean of the proxy for stock market development that is a variable in the relevant regression.

Before turning to the results, note that similarly we can write the variance of differenced consumption relative to differenced GNP as follows

$$\frac{var(c_t - c_{t-1})}{var(GNP_t - GNP_{t-1})} = (1 - \alpha_c)^2 \qquad (2.19)$$

The elasticity of this variance ratio to the debt market transaction parameter, α_c, is given by

$$\zeta_1 = \frac{\partial}{\partial \alpha_s}\left(\frac{var(c_t - c_{t-1})}{var(GNP_t - GNP_{t-1})}\right) \bullet \frac{\alpha_s}{\frac{var(c_t - c_{t-1})}{var(GNP_t - GNP_{t-1})}} = \frac{-2\alpha_c}{1 - \alpha_c} \qquad (2.20)$$

[8] Alternatively, the elasticity of the standard deviation of differenced GNP relative to the standard deviation of differenced GDP w.r.t. α_s can be calculated as $\zeta_1' = \frac{\partial}{\partial \alpha_s}\left(\frac{\sigma_{(GNP_t - GNP_{t-1})}}{\sigma_{(GDP_t - GDP_{t-1})}}\right) \bullet \frac{\alpha_s}{\frac{\sigma_{(GNP_t - GNP_{t-1})}}{\sigma_{(GDP_t - GDP_{t-1})}}} = \frac{-\alpha_s}{1-\alpha_s}$, which is half of the elasticity of the analogous variance ratio in (2.18).

where now $\alpha_c = \beta_s C$ with C standing for overall (domestic or international) debt market development.

Finally, note that the ratio of the variance of differenced consumption to the variance of differenced GDP is given by

$$\frac{var(c_t - c_{t-1})}{var(GDP_t - GDP_t)} = (1-\alpha_s)^2(1-\alpha_c)^2 \tag{2.21}$$

Now we can find the two elasticities of this ratio with respect to the two financial market restriction parameters, α_s and α_c, as follows

$$\zeta_{3,\alpha_s} = \frac{\partial}{\partial \alpha_s}\left(\frac{var(c_t - c_{t-1})}{var(GDP_t - GDP_t)}\right) \bullet \frac{\alpha_s}{\frac{var(c_t - c_{t-1})}{var(GDP_t - GDP_t)}} = \frac{-2\alpha_s}{1-\alpha_s} \tag{2.22}$$

$$\zeta_{3,\alpha_c} = \frac{\partial}{\partial \alpha_c}\left(\frac{var(c_t - c_{t-1})}{var(GDP_t - GDP_{t-1})}\right) \bullet \frac{\alpha_c}{\frac{var(c_t - c_{t-1})}{var(GDP_t - GDP_{t-1})}} = \frac{-2\alpha_c}{1-\alpha_c} \tag{2.23}$$

Table 2.13A first presents the estimated elasticity of the relative variance of GNP and GDP with respect to proxies for equity market development. The estimates are based on the coefficients for *MCap* and *Turn* in the final regressions in Tables 2.3A, 2.4A and 2.5A. The figures can be interpreted to indicate how much the variance of GNP growth relative to GDP growth changes by having an increase in one of the domestic equity market variables of one percent. For example, a one percent increase in stock market capitalization relative to GDP evaluated at the mean value can reduce the relative variance of GNP growth to GDP growth rate by 0.079 percent for the OECD sample. To illustrate that this number is not negligible, we can conduct a thought experiment as follows. The mean value of OECD countries' stock market capitalization relative to GDP is 57% and the relative variance of GNP growth to GDP growth rate for all OECD countries is 1.003. By increasing the level of stock market capitalization by 50 percent, i.e. up to 85.5%, the relative variance of GNP growth and GDP growth for OECD countries will decrease by 50%*0.079=3.95%. The new relative variance of GNP and GDP would be 0.963. As seen in the table, the magnitude of the effects of domestic equity market development - expressed as elasticities - on the relative GNP variance is much smaller for non-OECD countries than for OECD counties. We do not compute analogous elasticity estimates using international equity measures, as the underlying regression coefficients in several instances are statistically insignificant in Tables 2.3 through 2.5.

Table 2.13B provides the estimated elasticity of the variance of consumption growth (relative to GNP growth) with respect to both domestic and international indicators. These are based on regression coefficients taken from Tables 6 through 8. In each case, the regression coefficient used is the one from a regression where the corresponding variable is the only included financial market variable in the regression. The estimated elasticity for *CredPriv* for the world sample, for instance, is taken from the first regression in Table 2.6A. We see that the estimated elasticities in Table 2.13B tend to be larger than those reported in Table 2.13A. This suggests that credit market development is more effective in reducing the variance of consumption relative to GNP than equity market development is in reducing the variance of GNP relative to GDP. To take an example, a one percent increase of the sum of the international debt asset and liability stock measured by either *TotDebt* or *TotDebt'* evaluated at the mean value decreases the variance of the consumption growth relative to GNP growth rate by 0.48 percent and 0.28 percent respectively, for non-OECD countries. We also see that the elasticity of this relative consumption variance w.r.t. the domestic debt variables (*CredPriv* or *CredBank'*) is relatively large for OECD countries, while the elasticity of this relative consumption variance with respect to an international debt variable (*TotDebt* (OECD) vs. *TotDebt* (non-OECD) or *TotDebt'* (non-OECD)) is relatively large for non-OECD countries.

Table 2.13C presents the estimated elasticity of the variance of consumption growth relative to GDP growth rate with respect to debt and equity market development jointly. The first two lines of Table 2.13C are based on the second regressions in Tables 2.10A, 2.11A and 2.12A. The third and fourth lines of Table 2.13C are based on the first regression of Table 2.10B, the regression in Table 2.11B, and the first regression in Table 2.12B. The estimated elasticities are generally sizeable. It is seen that domestic equity and debt market development matters more for OECD countries than for non-OECD countries in terms of the shown elasticities, while international equity and debt market integration matters more for non-OECD countries. These elasticity results are consistent with the "level" results in Table 2.9 comparing the impact of domestic and international debt market development on reducing the variability of consumption relative to GNP for OECD and non-OECD countries.

2.5 Discussion and conclusions

In this chapter we use a simple theoretical model to illustrate how a representative consumer smooths his consumption under a restricted availability

of debt and equity market instruments due to imperfect domestic and international debt and equity markets. The model yields testable implications regarding the co-movements of GDP, GDP and consumption for a given level of domestic or international debt and equity market development. These implications are explored using a variety of empirical proxies for domestic and international debt and equity market development that are familiar from the empirical literature on the finance and growth nexus.

The empirical results confirm that the extent to which consumption smoothing is possible in the face of output or GDP shocks depends importantly on the level of financial development. The domestic and international aspects of financial development turn out to play distinct roles in reducing consumption variability. Specifically, we find that domestic debt market development is more relevant for reducing consumption variability relative to GNP for OECD member countries than for non-member countries, while international debt market development is relatively important for OECD non-member countries in reducing consumption variability. Similarly, we find that debt and equity market developments have independent roles in reducing the variability of consumption relative to GDP. They are to some extent substitutes in that more of one can make up for less of the other. Calculated elasticities suggest that credit market development is more potent than equity market development in reducing the variability of consumption relative to GNP[9]. Generally, the calculated elasticities suggest that financial market development can have economically relevant effects in reducing consumption variability relative to GNP. Consistent with the theoretical model, we also find empirical support for the hypothesis that a higher level of equity market development reduces the potential for debt market development to reduce the variability of consumption relative to GDP, and vice versa.

There are several avenues for further research. At a theoretical level, existing models of imperfections in international debt and equity markets can be extended to see how the determinants of these restrictions in the end determine the scope for international consumption smoothing. At the empirical level, similarly it may be possible to consider some of the determinants of domestic and international financial development, such as the nature of legal systems, to see how these determinants impact on actual consumption smoothing.

At a policy level, the knowledge that financial sector development helps to smooth consumption should provide an impetus to take measures that pro-

[9]This study uses annual data. Instead, one could examine the co-movements of consumption and GDP or GNP taking three or five year intervals. Over longer periods, equity market development may be relatively important in smoothing consumption, as suggested by findings in Melitz and Zumer (1999).

mote such development. The results of this chapter suggest that gross stock variables derived from the balance of payments help to explain a country's consumption smoothing possibilities. The gross financial stock variables of one country are likely to be directly affected by financial sector development in other countries. This reflects that international consumption smoothing requires the active involvement of at least two countries. Financial market development in one country thus is likely to increase the consumption smoothing options available to other countries. The potentially beneficial effects of national financial sector development on consumption smoothing possibilities and welfare abroad provides policy makers with an additional reason to aim for financial sector development.

Appendix to Chapter 2

2A Variable definitions

- Growth rates

GDPg : Annual percentage growth rate of GDP per capita based on constant local currency. Per capita number is obtained by dividing total GDP by midyear population (Source: WDI).

GNPg : Annual percentage growth rate of GNP per capita based on constant local currency (Source: WDI).

CONg : Annual percentage growth rate of per capita final consumption based on constant local currency. Final consumption is the sum of household final consumption expenditure and general government final consumption expenditure (Source: WDI).

- Domestic financial variables

MCap : Stock market capitalization as a percent of GDP. Listed domestic companies are the domestically incorporated companies listed on the country's stock exchanges at the end of the year (Source: WDI).

Turn : Stock market turnover ratio computed as the total value of shares traded during the period divided by the average market capitalization for the period (Source: WDI).

CredPriv : Domestic debt to private sector as a percent of GDP. This domestic debt is financial resources provided to the private sector, such as through loans, purchases of non-equity securities, and trade credits and other accounts receivable, that establish a claim for repayment. For some countries these claims include debt to public enterprises (Source: WDI).

CredBank : Domestic debt provided by banking sector as a percent of GDP. Debt is on a gross basis, with the exception of debt to the central government, which is net. The banking sector includes monetary authorities and deposit money banks, as well as other banking institutions, such as savings and mortgage loan institutions, building and loan associations (Source: WDI).

M3 : Liquid liabilities as a percent of GDP. Liquid liabilities are the sum of currency and deposits in the central bank (M0), plus transferable deposits and electronic currency (M1), plus time and savings deposits, foreign currency transferable deposits, certificates of deposit, and securities repurchase agreements (M2), plus travelers checks, foreign currency time deposits, commercial paper, and shares of mutual funds or market funds held by residents (Source: WDI).

Spread : Interest rate spread. The spread is the interest rate charged by banks on loans to prime customers minus the interest rate paid by commercial or similar banks for demand, time, or savings deposits (Source: WDI).

- International financial variables

FDI : Stock of foreign direct investment assets and liabilities as a percent of GDP. Estimated by Milesi-Ferretti using cumulative flow adjusted for relative price variations (Source: Lane and Milesi-Ferretti, 2001).

PortEq : Stock of portfolio equity assets and liabilities a percent of GDP. Estimated by Lane and Milesi-Ferretti using cumulative flow adjusted for relative price variations (Source: Lane and Milesi-Ferretti, 2001).

TotEq: Gross stock of international equity as a percent of GDP. Sum of *FDI* and *Portfolio-Equity* (Source: Lane and Milesi-Ferretti, 2001).

IntBank : Gross stock of other investment assets and liabilities as a percent of GDP. Other investment includes trade credit, loans, currency and deposit, etc. For developed countries (Source: BOPS and IFS, International Investment Position).

PortDebt : Gross stock of portfolio debt assets and liabilities as a percent of GDP. For developed countries (Source: BOPS and IFS, International Investment Position).

TotDebt (OECD) : Gross stock of total debt assets and liabilities as a percent of GDP. Sum of *IntBank* and *Portfolio-debt*; For developed countries.

TotDebt (non-OECD) and *TotDebt′ (non-OECD):* Gross stock of portfolio debt and other investment (mainly from banks) as a percent of GDP. For developing countries (Source: OECD and Lane and Milesi-Ferretti, 2001). Alternative measures of the stock of total debt assets, namely ASSETS2 and CUMLOAN appearing in Lane & Milesi-Ferretti original data set, are added respectively to OECD collected data on total debt liability, leading to TotDebt and TotDebt′ correspondingly.

TotDebt (for the world) and *TotDebt′ (for the world):* These series combine *TotDebt (OECD)* for OECD countries with two alternative measures, *TotDebt (non-OECD)* and *TotDebt′ (non-OECD),* for non-OECD countries leading to two alternative worldwide measures of gross debt. The alternative *TotDebt* and *TotDebt'* gross indebtedness measures for non-OECD countries are the sums of one series of debt liabilities provided by the OECD and two alternative measures of debt assets as estimated by Lane and Milesi-Ferretti (2001).

2B Tables

Table 2.1: Summary statistics

Variables	The whole sample				
Growth rates					
	Obs.	Mean	S. D.	Min	Max
GDPg	5907	1.90	5.50	-19.73	42.99
GNPg	5633	1.95	5.91	-19.74	47.35
CONg	4371	2.13	6.62	-19.54	47.56
Domestic Finance					
MCap	1142	40.64	54.37	0	549.88
Turn	778	42.23	53.00	0	475.46
CredPriv	5283	34.06	30.66	.56	203.17
CredBank	5150	47.00	39.14	.00	333.99
M3	5012	41.99	34.72	0	753.98
Spread	2869	7.16	7.78	-9.25	91.76
Int. Finance: Gross					
FDI	1858	16.01	17.94	0	127.22
PortEq	1724	4.42	16.00	0	343.32
TotEq	1671	21.32	30.28	0	438.11
IntBank					
PortDebt					
TotDebt	976	80.36	68.29	10.54	606.55
TotDebt′	1078	93.94	85.09	10.54	606.55
Int. Finance: Net					
FDI	1858	-8.29	15.60	-110.90	34.74
PortEq	1724	-.81	9.05	-246.83	97.14
TotEq	1671	-9.67	18.21	-258.80	45.65
IntBank					
PortDebt					
TotDebt	976	-45.66	39.08	-204.84	99.74
TotDebt′	1078	-24.40	70.63	-192.23	337.17

Table 2.1(Continued 1): Summary statistics

Variables	OECD countries				
Growth rates					
	Obs.	Mean	S. D.	Min	Max
GDPg	1122	2.78	3.07	-14.57	18.18
GNPg	1072	2.72	3.08	-14.90	12.45
CONg	1082	2.59	2.72	-18.07	24.11
Domestic Finance					
MCap	388	57.19	57.64	.19	549.87
Turn	255	72.16	54.11	.7	380.3
CredPriv	1094	61.79	37.06	1.68	203.17
CredBank	1094	78.95	43.48	14.24	319.38
M3	789	60.76	31.53	9.94	199.56
Spread	628	4.10	2.57	-9.25	20.46
Int. Finance: Gross					
FDI	420	23.57	19.96	.64	127.22
PortEq	308	15.70	20.95	.25	160.98
TotEq	303	45.93	37.36	4.40	251.34
IntBank	515	77.76	69.40	9.77	546.17
PortDebt	355	25.72	22.90	.037	95.64
TotDebt	348	100.16	94.35	10.54	606.55
TotDebt′					
Int. Finance: Net					
FDI	420	-1.79	10.67	-55.15	34.40
PortEq	308	-1.65	7.99	-59.26	23.84
TotEq	303	-3.25	11.69	-46.29	22.41
IntBank	515	-14.75	23.61	-194.83	28.34
PortDebt	355	-8.61	20.27	-53.72	75.04
TotDebt	348	-16.04	28.41	-92.28	99.74
TotDebt′					

Table 2.1(Continued 2): Summary statistics

Variables	Non-OECD countries				
Growth rates					
	Obs.	Mean	S. D.	Min	Max
GDPg	4785	1.70	5.91	-19.73	42.99
GNPg	4561	1.76	6.38	-19.74	47.35
CONg	3289	1.98	7.47	-19.54	47.56
Domestic Finance					
MCap	754	32.13	50.57	0	385.12
Turn	523	27.63	45.89	0	475.46
CredPriv	4189	26.82	23.96	.56	180.17
CredBank	4056	39.65	33.27	.00	333.99
M3	4223	38.49	34.16	0	753.98
Spread	2241	8.02	8.51	-8.85	91.76
Int. Finance: Gross					
FDI	1438	15.17	18.10	0	124.28
PortEq	1416	2.01	14.10	0	343.32
TotEq	1368	17.30	27.04	0	438.11
IntBank					
PortDebt					
TotDebt	628	60.97	33.86	11.02	204.84
TotDebt$'$	730	72.61	41.14	12.42	242.59
Int. Finance: Net					
FDI	1438	-12.67	16.34	-110.90	32.38
PortEq	1416	-0.66	10.11	-246.83	97.14
TotEq	1368	-13.39	18.98	-258.80	45.65
IntBank					
PortDebt					
TotDebt	628	-59.11	34.46	-204.84	-10.05
TotDebt$'$	730	-32.46	59.63	-192.23	377.17

Notes: The sample consists of yearly data for the period 1960-2001 for a worldwide set of countries, for OECD countries, and for non-OECD countries, respectively. International financial variables (FDI, PortEq, TotEq, TotDebt, TotDebt$'$) are available only for the period 1970-1998.

Table 2.2: Correlation coefficients

A. Growth Rates

	GDPg	GNPg	CONSg
GDPg	1		
GNPg	0.9136*	1	
CONSg	0.5448*	0.5452*	1

B. Financial Variables

	MCap	Turn	CredPriv	CredBank	M3	Spread
MCap	1					
Turn	0.1590*	1				
CredPriv	0.6237*	0.2787*	1			
CredBank	0.4875*	0.2591*	0.7647*	1		
M3	0.5656*	0.2067*	0.7284*	0.7592*	1	
Spread	-0.0612	-0.1986*	-0.0524*	-0.3080	-0.4450*	1
FDI	0.4850*	0.0373*	0.2949*	0.1515*	0.2452*	-0.0305
PortEq	0.5739*	0.2103*	0.4797*	0.3673*	0.3900*	-0.0314
TotEq	0.5866*	0.1309*	0.4258*	0.2701*	0.3513*	-0.0377
TotDebt	0.2195*	0.2662*	0.0430	0.2520*	0.2444*	-0.0317
TotDebt′	0.0089	0.0734	0.1115*	0.2915*	0.3381*	-0.0123

	FDI	PortEq	TotEq	TotDebt
MCap				
Turn				
CredPriv				
CredBank				
M3				
Spread				
FDI	1			
PortEq	0.5080*	1		
TotEq	0.7220*	0.6842	1	
TotDebt	0.0140	-0.1305*	-0.0350	1
TotDebt′	0.0450	-0.0048	0.0178	0.9238*

Notes: The sample consists of yearly data for the period 1960-2001 for a set of OECD and non-OECD countries. International financial variables (FDI, PortEq, TotEq, TotDebt, TotDebt′) are available only for the period 1970-1998. For variable definitions, see the appendix. * indicates significant at 5% level.

Table 2.3: Co-movements of GNP growth and GDP growth for worldwide sample

A. Domestic measures

	(1)	(2)	(3)
GDPg	1.014** (0.002)	1.028**(0.005)	1.043**(0.005)
MCap	-0.032**(0.007)		-0.033**(0.011)
Turn		-0.012**(0.005)	-0.007**(0.002)
Const.	0.037**(0.014)	0.018**(0.012)	0.015**(0.004)
Obs.	1133	767	761

B. International measures: gross

	(1)	(2)	(3)	(4)
GDPg	1.017** (0.004)	1.014**(0.004)	1.016** (0.004)	1.017**(0.004)
FDI	0.021(0.026)			-0.003(0.036)
PortEq		0.068(0.045)		0.061(0.060)
TotEq			0.020 (0.018)	
Const.	-0.053**(0.015)	-0.036*(0.015)	-0.041**(0.015)	-0.042**(0.016)
Obs.	1772	1642	1589	1589

C. International measures: net

	(1)′	(2)′	(3)′	(4)′
GDPg	1.017**(0.004)	1.016**(0.004)	1.015**(0.004)	1.015**(0.004)
FDI	-0.029(0.037)			-0.050^{+}(0.038)
PortEq		0.071(0.103)		-0.094(0.101)
TotEq			-0.036(0.036)	
Const.	-0.056**(0.015)	-0.033**(0.015)	-0.042**(0.016)	-0.045**(0.016)
Obs.	1772	1642	1589	1589

D. International measures: dummy

	(1)"	(2)"	(3)"	(4)"
GDPg	1.023**(0.005)	1.015**(0.004)	1.024**(0.005)	1.024**(0.005)
FDI	-0.001(0.013)			-0.019^{+}(0.014)
PortEq		0.005(0.009)		-0.004(0.012)
TotEq			-0.023^{+}(0.014)	
Const.	-0.066**(0.019)	-0.034*(0.016)	-0.053**(0.020)	-0.052**(0.021)
Obs.	1772	1642	1589	1589

Notes: Results of regressions of the growth rate of GNP on the growth rate of GDP and an interaction term of a financial market measure in the left column with the growth rate of GDP. The sample consists of yearly data

for the period 1960-2001 for OECD and non-OECD countries. International financial variables (FDI, PortEq, and TotEq) are available only for the period 1970-1998. Domestic financial measures are the relevant domestic financial variables as a percent of GDP. International gross financial measures are the relevant foreign assets plus liabilities as a percent of GDP. International net financial measures are the relevant foreign assets minus foreign liabilities as a percent of GDP. International dummy financial measures are dummy variables that take on a value of one if the relevant foreign assets exceed foreign liabilities and zero otherwise. Estimation by FGLS allows for within country autocorrelation and across countries heteroskedasticity. For variable definitions, see the appendix. $^{+}$,*, ** indicates statistical significance at the 10%, 5%, 1% confidence level; number in parentheses is standard error.

Table 2.4: Co-movements of GNP growth and GDP growth for OECD countries

A. Domestic measures

	(1)	(2)	(3)
GDPg	1.010**(0.032)	0.885**(0.091)	0.948**(0.052)
MCap	-0.067**(0.020)		-0.116(0.105)
Turn		-0.084^{+}(0.053)	-0.079**(0.038)
Const.	0.014(0.068)	0.073(0.118)	0.014(0.123)
Obs.	388	255	254

B. International measures: gross

	(1)	(2)	(3)	(4)
GDPg	1.019**(0.011)	1.018**(0.014)	1.022**(0.016)	1.053**(0.016)
FDI	-0.010(0.044)			-0.220**(0.068)
PortEq		0.113*(0.060)		0.274**(0.078)
TotEq			0.018(0.031)	
Const.	-0.033(0.027)	-0.065**(0.031)	-0.057*(0.032)	-0.069**(0.030)
Obs.	325	246	245	245

C. International measures : net

	(1)′	(2)′	(3)′	(4)′
GDPg	1.020**(0.009)	1.032**(0.011)	1.036**(0.010)	1.033**(0.011)
FDI	0.002**(0.001)			0.002**(0.001)
PortEq		0.003*(0.002)		0.002(0.002)
TotEq			0.002**(0.001)	
Const.	-0.030(0.027)	-0.045^{+}(0.033)	-0.052*(0.030)	-0.047^{+}(0.031)
Obs.	310	231	230	230

D: International measures: dummy

	(1)"	(2)"	(3)"	(4)"
GDPg	1.005**(0.011)	1.026**(0.013)	1.007**(0.013)	1.009**(0.015)
FDI	0.032**(0.013)			0.043**(0.016)
PortEq		0.004(0.011)		-0.003(0.010)
TotEq			0.051**(0.013)	
Const.	-0.040^{+}(0.027)	-0.053*(0.032)	-0.058**(0.028)	-0.050^{+}(0.032)
Obs.	310	231	230	230

Notes: Results of regressions of the growth rate of GNP on the growth rate of GDP and an interaction term of a financial market measure in the left column with the growth rate of GDP. The sample consists of yearly data

for the period 1960-2001 for OECD countries. International financial variables (FDI, PortEq, and TotEq) are available only for the period 1970-1998. Domestic financial measures are the relevant domestic financial variables as a percent of GDP. International gross financial measures are the relevant foreign assets plus liabilities as a percent of GDP. International net financial measures are the relevant foreign assets minus foreign liabilities as a percent of GDP. International dummy financial measures are dummy variables that take on a value of one if the relevant foreign assets exceed foreign liabilities and zero otherwise. Estimation by FGLS allows for within country autocorrelation and across countries heteroskedasticity. For variable definitions, see the appendix. $^{+}$,*, ** indicates statistical significance at the 10%, 5%, 1% confidence level; number in parentheses is standard error.

Table 2.5: Co-movements of GNP growth and GDP growth for non-OECD countries

A. Domestic measures

	(1)	(2)	(3)
GDPg	1.044**(0.002)	1.064**(0.011)	1.111**(0.018)
MCap	-0.018**(0.002)		-0.021**(0.005)
Turn		-0.014**(0.003)	-0.008**(0.003)
Const.	0.078**(0.013)	0.022^{+}(0.013)	0.014^{+}(0.010)
Obs.	743	511	506

B. International measures: gross

	(1)	(2)	(3)	(4)
GDPg	1.012**(0.006)	1.011**(0.005)	1.011**(0.006)	1.011**(0.006)
FDI	0.055(0.043)			0.043(0.047)
PortEq		0.202(0.150)		0.113(0.151)
TotEq			0.055(0.047)	
Const.	-0.056**(0.026)	-0.050^{+}(0.026)	-0.053**(0.026)	-0.053*(0.026)
Obs.	1115	1164	1111	1111

C. International measures: net

	(1)′	(2)′	(3)′	(4)′
GDPg	1.008**(0.006)	1.013**(0.005)	1.007**(0.006)	1.007**(0.006)
FDI	-0.001**(0.000)			-0.001**(0.000)
PortEq		0.001(0.002)		0.001(0.002)
TotEq			-0.001**(0.000)	
Const.	-0.057**(0.025)	-0.046*(0.026)	-0.052**(0.025)	-0.052**(0.025)
Obs.	1115	1164	1111	1111

D: International measures: dummy

	(1)"	(2)"	(3)"	(4)"
GDPg	1.029**(0.006)	1.011**(0.005)	1.028**(0.006)	1.027**(0.006)
FDI	-0.101**(0.049)			-0.103**(0.050)
PortEq		0.013(0.020)		0.015(0.022)
TotEq			-0.059^{+}(0.039)	
Const.	-0.064**(0.028)	-0.051*(0.026)	-0.061**(0.028)	-0.061**(0.028)
Obs.	1115	1164	1111	1111

Notes: Results of regressions of the growth rate of GNP on the growth rate of GDP and an interaction term of a financial market measure in the left column with the growth rate of GDP. The sample consists of yearly data for

the period 1960-2001 for non-OECD countries. International financial variables (FDI, PortEq, and TotEq) are available only for the period 1970-1998. Domestic financial measures are the relevant domestic financial variables as a percent of GDP. International gross financial measures are the relevant foreign assets plus liabilities as a percent of GDP. International net financial measures are the relevant foreign assets minus foreign liabilities as a percent of GDP. International dummy financial measures are dummy variables that take on a value of one if the relevant foreign assets exceed foreign liabilities and zero otherwise. Estimation by FGLS allows for within country autocorrelation and across countries heteroskedasticity. For variable definitions, see the appendix. $^{+}$,*, ** indicates statistical significance at the 10%, 5%, 1% confidence level; number in parentheses is standard error.

Table 2.6: Co-movements of consumption growth and GNP growth for worldwide sample

A. Domestic measures

	(1)	(2)	(3)	(4)
GNPg	0.679**(0.016)	0.689**(0.017)	0.675**(0.019)	0.651**(0.013)
CredPriv	-0.087**(0.026)			
CredBank		-0.079**(0.023)		
M3			-0.060*(0.030)	
Spread				0.043(0.061)
Const.	0.739**(0.046)	0.732**(0.046)	0.682**(0.050)	0.638**(0.042)
Obs.	3968	3956	3707	2302

B. International measures: gross

	(1)	(2)
GNPg	0.829**(0.028)	0.891**(0.028)
TotDebt	-0.133**(0.028)	
TotDebt′		-0.207**(0.027)
Const.	0.317**(0.064)	0.262**(0.066)
Obs.	748	811

C. International measures: net

	(1)′	(2)′
GNPg	0.719**(0.029)	0.628**(0.021)
TotDebt	-0.034(0.050)	
TotDebt′		-0.200**(0.037)
Const.	0.315**(0.071)	0.401**(0.065)
Obs.	747	811

D. International measures: dummy

	(1)"	(2)"
GNPg	0.735**(0.019)	0.734**(0.019)
TotDebt	-0.290**(0.055)	
TotDebt′		-0.392**(0.052)
Const.	0.359**(0.063)	0.389**(0.067)
Obs.	747	811

Notes: Results of regressions of the growth rate of consumption on the growth rate of GNP and an interaction term of a financial market measure in the left column with the growth rate of GNP. The sample consists of yearly

data for the period 1960-2001 for OECD and non-OECD countries. International financial variables (TotDebt and TotDebt$'$) are available only for the period 1970-1998. Domestic financial measures are the relevant domestic financial variables as a percent of GDP. International gross financial measures are the relevant foreign assets plus liabilities as a percent of GDP. International net financial measures are the relevant foreign assets minus foreign liabilities as a percent of GDP. International dummy financial measures are dummy variables that take on a value of one if the relevant foreign assets exceed foreign liabilities and zero otherwise. Estimation by FGLS allows for within country autocorrelation and across countries heteroskedasticity. For variable definitions, see the appendix. $^{+}$,*, ** indicates statistical significance at the 10%, 5%, 1% confidence level; number in parentheses is standard error.

Table 2.7: Co-movements of consumption growth and GNP growth for OECD countries

A. Domestic measures

	(1)	(2)	(3)	(4)
GNPg	0.714**(0.030)	0.720**(0.029)	0.706**(0.036)	0.526**(0.028)
CredPriv	-0.149**(0.036)			
CredBank		-0.131**(0.032)		
M3			-0.124**(0.048)	
Spread				1.904**(0.506)
Const.	0.864**(0.063)	0.869**(0.063)	0.832**(0.073)	0.767**(0.063)
Obs.	993	993	708	617

B. International measures: gross

	(1)	(2)	(3)	(4)
GNPg	0.635**(0.037)	0.668**(0.040)	0.679**(0.043)	0.650**(0.043)
IntBank	-0.081**(0.038)		-0.032(0.048)	
PortDebt		-0.339**(0.103)	0.301**(0.126)	
TotDebt				-0.091**(0.032)
Const.	0.675**(0.081)	0.694**(0.084)	0.691**(0.084)	-0.689**(0.084)
Obs.	346	281	280	280

C. International measures: net

	(1)′	(2)′	(3)′	(4)′
GNPg	0.528**(0.029)	0.521**(0.031)	0.515**(0.032)	0.515**(0.032)
IntBank	-0.005**(0.001)		-0.001(0.002)	
PortDebt		-0.002**(0.001)	-0.002*(0.001)	
TotDebt				-0.002**(0.001)
Const.	0.738**(0.082)	0.685**(0.082)	0.694**(0.085)	0.705**(0.083)
Obs.	346	281	280	280

D. International measures: dummy

	(1)"	(2)"	(3)"	(4)"
GNPg	0.612**(0.030)	0.570**(0.030)	0.601**(0.030)	0.588**(0.029)
IntBank	-0.093**(0.043)		-0.095**(0.039)	
PortDebt		-0.070(0.056)	-0.080*(0.056)	
TotDebt				-0.188**(0.057)
Const.	0.677**(0.086)	0.745**(0.085)	0.791**(0.085)	0.736**(0.084)
Obs.	331	266	265	265

Notes: Results of regressions of the growth rate of consumption on the growth rate of GNP and an interaction term of a financial market measure

in the left column with the growth rate of GNP. The sample consists of yearly data for the period 1960-2001 for OECD countries. International financial variables (TotDebt and TotDebt′) are available only for the period 1970-1998. Domestic financial measures are the relevant domestic financial variables as a percent of GDP. International gross financial measures are the relevant foreign assets plus liabilities as a percent of GDP. International net financial measures are the relevant foreign assets minus foreign liabilities as a percent of GDP. International dummy financial measures are dummy variables that take on a value of one if the relevant foreign assets exceed foreign liabilities and zero otherwise. Estimation by FGLS allows for within country autocorrelation and across countries heteroskedasticity. For variable definitions, see the appendix. $^{+}$,*, ** indicates statistical significance at the 10%, 5%, 1% confidence level; number in parentheses is standard error.

Table 2.8: Co-movements of consumption growth and GNP Growth for non-OECD countries

A. Domestic measures

	(1)	(2)	(3)	(4)
GNPg	0.747**(0.043)	0.731**(0.054)	0.718**(0.067)	0.537**(0.034)
CredPriv	-0.030**(0.013)			
CredBank		-0.019^{+}(0.015)		
M3			-0.017(0.019)	
Spread				0.073**(0.014)
Const.	0.560**(0.069)	0.522**(0.068)	0.535**(0.068)	0.533**(0.088)
Obs.	2975	2897	2999	1660

B. International measures: gross

	(1)	(2)
GNPg	0.906**(0.054)	0.938**(0.038)
TotDebt	-0.184**(0.077)	
TotDebt$'$		-0.233**(0.043)
Const.	0.128(0.126)	0.121(0.118)
Obs.	418	493

C. International measures: net

	(1)$'$	(2)$'$
GNPg	0.751**(0.109)	0.647**(0.047)
TotDebt	-0.000*(0.000)	
TotDebt$'$		-0.002**(0.000)
Const.	0.054(0.221)	0.094(0.214)
Obs.	394	464

D. International measures: dummy

	(1)"	(2)"
GNPg	0.648 **(0.010)	0.779**(0.025)
TotDebt		
TotDebt$'$		-0.364**(0.101)
Const.	0.537**(0.069)	0.267**(0.117)
Obs.	2471	493

Notes: Results of regressions of the growth rate of consumption on the growth rate of GNP and an interaction term of a financial market measure in the left column with the growth rate of GNP. The sample consists of yearly data for the period 1960-2001 for non-OECD countries. International

financial variables (TotDebt and TotDebt′) are available only for the period 1970-1998. Domestic financial measures are the relevant domestic financial variables as a percent of GDP. International gross financial measures are the relevant foreign assets plus liabilities as a percent of GDP. International net financial measures are the relevant foreign assets minus foreign liabilities as a percent of GDP. International dummy financial measures are dummy variables that take on a value of one if the relevant foreign assets exceed foreign liabilities and zero otherwise. Estimation by FGLS allows for within country autocorrelation and across countries heteroskedasticity. For variable definitions, see the appendix. $^{+}$,*, ** indicates statistical significance at the 10%, 5%, 1% confidence level; number in parentheses is standard error.

The data for net stock of international debt for non-OECD countries are all negative so that all associated dummy variables are equal to zero. The interaction term between *GNPg* and *TotDebt* therefore is dropped from the regression.

Table 2.9: Co-movements of consumption growth and GNP growth: the roles of domestic and international debt variables

A. OECD countries

Variables	(1)	(2)
GNPg	1.020**(0.123)	0.904**(0.114)
Domestic		
CredPriv	-0.389*(0.123)	
CredBank		-0.206^{+}(0.113)
International		
TotDebt	-0.161(0.099)	-0.074(0.089)
TotDebt$'$		
Interaction		
CredPriv $*$ TotDebt	0.105(0.086)	
CredBank $*$ TotDebt		0.002(0.057)
Const.	0.569**(0.062)	0.589**(0.065)
Obs.	278	278

B. Non-OECD countries

Variables	(3)	(4)	(5)	(6)
GNPg	1.055**(0.094)	0.828**(0.077)	0.931**(0.093)	0.776**(0.077)
Domestic				
CredPriv	-0.259(0.178)	-0.130(0.182)		
CredBank			-0.006(0.131)	0.058(0.129)
International				
TotDebt	-0.511**(0.140)		-0.303^{+}(0.165)	
TotDebt$'$		-0.257**(0.127)		-0.168^{+}(0.093)
Interaction				
CredPriv*TotDebt$^{(\prime)}$	0.704**(0.265)	0.422(0.283)		
CredBank*TotDebt$^{(\prime)}$			0.125(0.204)	0.068(0.218)
Const.	0.187(0.130)	0.582**(0.137)	0.161(0.129)	0.566**(0.137)
Obs.	416	666	416	666

Notes: Results of regressions of the growth rate of consumption on the growth rate of GNP and interaction terms of the growth rate of GNP with (i) a domestic debt variable, (ii) an international debt variable, and (iii) the product of a domestic debt variable and an international debt variable, as stated in the left column. The sample consists of yearly data for the period 1960-2001 for OECD and non-OECD countries, respectively. International financial variables (TotDebt and TotDebt$'$) are available only for the period 1970-1998. Domestic financial measures are the relevant domestic financial

variables as a percent of GDP. International financial variables are measured in gross terms, i.e. as the relevant foreign assets and liabilities as a percent of GDP. Estimation by FGLS allows for within country autocorrelation and across countries heteroskedasticity. For variable definitions, see the appendix. $^{+}$,*, ** indicates statistical significance at the 10%, 5%, 1% confidence level; number in parentheses is standard error.

Table 2.10: Co-movements of consumption growth and GDP growth for worldwide sample

A. Domestic measures

GDPg	0.906**(0.015)	0.955**(0.011)
CredPriv	-0.156**(0.034)	
CredBank		-0.195**(0.025)
MCap	-0.105*(0.058)	-0.140**(0.050)
CredPriv * MCap	0.071^{+}(0.047)	
CredBank * MCap		0.098*(0.041)
Const.	0.327**(0.062)	0.324**(0.061)
Obs.	901	904

B. International measures: gross

GDPg	0.956**(0.041)	1.068**(0.043)
TotDebt	-0.093*(0.040)	
TotDebt$'$		-0.265**(0.048)
TotEq	-0.360**(0.120)	-0.374**(0.096)
TotDebt * TotEq	0.125*(0.060)	
TotDebt * TotEq		0.244**(0.066)
Const.	0.211**(0.070)	0.091(0.072)
Obs.	713	775

C. International measures: net

	$(1)'$	$(2)'$
GDPg	0.767**(0.030)	0.710**(0.025)
TotDebt	-0.067(0.053)	
TotDebt$'$		-0.189**(0.047)
TotEq	-0.466**(0.135)	-0.224**(0.104)
TotDebt * TotEq	0.000(0.000)	
TotDebt$'$ * TotEq		0.000*(0.000)
Const.	0.143^{+}(0.074)	0.246**(0.071)
Obs.	713	775

D. International measures: dummy

	(1)"	(2)"
GDPg	0.843**(0.020)	0.862**(0.022)
TotDebt	-0.334**(0.113)	
TotDebt′		-0.131*(0.071)
TotEq	-0.131**(0.022)	-0.145**(0.026)
TotDebt ∗ TotEq	$0.151^{(1)}$(0.124)	
TotDebt′ ∗ TotEq		0.301**(0.129)
Const.	0.212**(0.067)	0.162**(0.077)
Obs.	713	775

Notes: Results of regressions of the growth rate of consumption on the growth rate of GDP and interaction terms of the growth rate of GDP with (i) a debt variable, (ii) an equity variable, and (iii) the product of a debt variable and an equity variable as stated in the left columns. The sample consists of yearly data for the period 1960-2001 for OECD and non-OECD countries, respectively. International financial variables (TotDebt TotDebt′, and TotEq) are available only for the period 1970-1998. Domestic financial measures are the relevant domestic financial variables as a percent of GDP. International gross financial measures are the relevant foreign assets and liabilities as a percent of GDP. International net financial measures are the relevant foreign assets minus foreign liabilities as a percent of GDP. International dummy financial measures are dummy variables that take on a value of one if the relevant foreign assets exceed foreign liabilities and zero otherwise. Estimation by FGLS allows for within country autocorrelation and across countries heteroskedasticity. For variable definitions, see the appendix. $^{+}$,*, ** indicates statistical significance at the 10%, 5%, 1% confidence level; number in parentheses is standard error.

Table 2.11: Co-movements of consumption growth and GDP growth for OECD countries

A. Domestic measures

	(1)	(2)
GDPg	0.910**(0.073)	0.963**(0.072)
CredPriv	-0.285**(0.080)	
CredBank		-0.290**(0.064)
MCap	-0.258**(0.096)	-0.298**(0.084)
CredPriv ∗ MCap	0.199*(0.085)	
CredBank ∗ MCap		0.211**(0.068)
Const.	0.451**(0.078)	0.442**(0.075)
Obs.	371	371

B. International measures: gross

GDPg	0.837**(0.074)
TotDebt	-0.067(0.062)
TotEq	-0.052**(0.139)
TotDebt ∗ TotEq	0.147*(0.071)
Const.	0.516**(0.082)
Obs.	239

C. International measures: net

GDPg	0.567**(0.035)
TotDebt	-0.001**(0.000)
TotEq	-0.004*(0.002)
TotDebt ∗TotEq	0.000(0.000)
Const.	0.648**(0.082)
Obs.	239

D. International measures: dummy

GDPg	0.697**(0.030)
TotDebt	-0.212**(0.096)
TotEq	-0.034^{+}(0.025)
TotDebt ∗TotEq	-0.020(0.107)
Const.	0.517**(0.793)
Obs.	224

Notes: Results of regressions of the growth rate of consumption on the growth rate of GDP and interaction terms of the growth rate of GDP with (i) a debt variable, (ii) an equity variable, and (iii) the product of a debt

variable and an equity variable as stated in the left columns. The sample consists of yearly data for the period 1960-2001 for OECD countries. International financial variables (TotDebt, TotDebt′, and TotEq) are available only for the period 1970-1998. Domestic financial measures are the relevant domestic financial variables as a percent of GDP. International gross financial measures are the relevant foreign assets plus liabilities as a percent of GDP. International net financial measures are the relevant foreign assets minus foreign liabilities as a percent of GDP. International dummy financial measures are dummy variables that take on a value of one if the relevant foreign assets exceed foreign liabilities and zero otherwise. Estimation by FGLS allows for within country autocorrelation and across countries heteroskedasticity. For variable definitions, see the appendix. $^{+}$,*, ** indicates statistical significance at the 10%, 5%, 1% confidence level; number in parentheses is standard error.

Table 2.12: Co-movements of consumption growth and GDP growth for non-OECD countries

A. Domestic measures

GDPg	1.308**(0.139)	1.426**(0.097)
CredPriv	-0.140**(0.045)	
CredBank		-0.146**(0.033)
MCap	-0.060^{+}(0.047)	-0.112**(0.047)
CredPriv $*$ MCap	0.023*(0.013)	
CredBank $*$ MCap		0.032**(0.012)
Const.	0.276**(0.094)	0.267**(0.096)
Obs.	530	518

B. International measures: gross

	(1)	(2)
GDPg	1.066**(0.102)	1.190**(0.058)
TotDebt	-0.236^{+}(0.148)	
TotDebt$'$		-0.348**(0.063)
TotEq	-0.247(0.561)	-0.760**(0.289)
TotDebt $*$ TotEq	0.180(0.890)	
TotDebt$'$*TotEq		0.714**(0.308)
Const	-0.09*(0.140)	-0.038 (0.127)
Obs.	414	488

C. International measure: net

	$(1)'$	$(2)'$
GDPg	1.006**(0.107)	0.814**(0.046)
TotDebt	0.001(0.002)	
TotDebt$'$		-0.002**(0.001)
TotEq	0.004(0.006)	0.002(0.002)
TotDebt $*$ TotEq	0.000(0.000)	
TotDebt$'$*TotEq		0.000*(0.000)
Const.	0.058(0.141)	0.065(0.127)
Obs.	391	461

D. International measures: dummy

	(1)"	(2)"
GDPg	0.740**(0.034)	0.889**(0.029)
TotDebt		
TotDebt′		-0.096(0.083)
TotEq		-0.143(0.156)
TotDebt ∗ TotEq		
TotDebt′ ∗TotEq		-0.753**(0.288)
Const.	0.388**(0.145)	-0.022(0.132)
Obs.	2490	488

Notes: Results of regressions of the growth rate of consumption on the growth rate of GDP and interaction terms of the growth rate of GDP with (i) a debt variable, (ii) an equity variable, and (iii) the product of a debt variable and an equity variable as stated in the left columns. The sample consists of yearly data for the period 1960-2001 for non-OECD countries. International financial variables (TotDebt, TotDebt′, and TotEq) are available only for the period 1970-1998. Domestic financial measures are the relevant domestic financial variables as a percent of GDP. International gross financial measures are the relevant foreign assets plus liabilities as a percent of GDP. International net financial measures are the relevant foreign assets minus foreign liabilities as a percent of GDP. International dummy financial measures are dummy variables that take on a value of one if the relevant foreign assets exceed foreign liabilities and zero otherwise. Estimation by FGLS allows for within country autocorrelation and across countries heteroskedasticity. For variable definitions, see the appendix. $^{+}$,*, ** indicates statistical significance at the 10%, 5%, 1% confidence level; number in parentheses is standard error.

Table 2.13: Estimated elasticities of relative variances w.r.t. financial variables

A. Elasticity of variance of GNP growth (relative to GDP growth) w.r.t. equity market variables

	World	OECD	Non-OECD
MCap	-0.027	-0.079	-0.012
Turn	-0.023	-0.129	-0.008

B. Elasticity of variance of consumption growth (relative to GNP growth) w.r.t. debt market variables

	World	OECD	Non-OECD
CredPriv	-0.06	-0.20	-0.02
CredBank	-0.08	-0.23	-0.02
IntBank		-0.12	
PortDebt		-0.20	
TotDebt	-0.23	-0.19	-0.28
TotDebt′	-0.46		-0.48

C. Elasticity of variance of consumption growth (relative to GDP growth) w.r.t. debt and equity market variables

	World	OECD	Non-OECD
CredBank	-0.202	-0.594	-0.123
MCap	-0.121	-0.410	-0.075
TotDebt	-0.362	-0.144	-0.538
TotEq	-0.167	-0.052	-0.301

Notes: Panel A presents the estimated elasticity of the relative variance of GNP and GDP with respect to proxies for equity market development. The estimates are partly based on the coefficients for MCap and Turn in regressions (1)s and (2)s in Tables 3A, 4A and 5A. Panel B provides the estimated elasticity of the variance of consumption growth (relative to GNP growth) with respect to both domestic and international indicators. These are based on regression coefficients taken from Tables 6A, 6B through 8A, 8B.

In each case, the regression coefficient used is the one from a regression where the corresponding variable is the only included financial market variable in the regression. We use international gross regressions (thus Table 2.6B, 7B, and 8B) for estimating the corresponding elasticities. Table 2.13C presents the estimated elasticity of the variance of consumption growth relative to GDP growth rate with respect to debt and equity market development jointly. The first two lines of Table 2.13C are based on the second regressions in Tables 10A, 11A and 12A. The last two lines of Table 2.13C are based on the first regression of Table 2.10B, the regression in Table 2.11B, and the first regression in Table 2.12B.

Chapter 3

Financial Structure, Macroeconomic Volatility and Downturns: Theory and Evidence

3.1 Introduction

During the past ten years, the American and British economies have been relatively tranquil. Activities have continued to fluctuate, but less violently than before. Severe recessions have been avoided. But Japan and Germany have under-performed compared to Anglo-Saxon countries as far as maintaining economic stability and preventing economic downturn are concerned. Does financial structure make a difference for macroeconomic fluctuations in general, and economic downturns in particular? This has not been paid sufficient attention. It is well documented (see, for example, Allen and Gale, 1995; and Black and Moersch, 1998) that Anglo-Saxon economies have a market-based financial structure and Japan and Germany have a bank-based financial structure. Are the different performances in terms of economic stability of these major economies a mere coincidence with their distinct financial structure, or are there some causal mechanisms at work?

Exploration of the causes and mechanisms behind output fluctuations has been a macroeconomic focus for decades. In a frictionless classical paradigm with full employment of resources, fluctuations in output are regarded as results of the changes in technology. But it is hard to attribute the economic downturn in a large and closed economy, for example, to preferences or technological changes, since domestic preference and technology are normally

stable. Half a century ago, the Keynesian framework shifted the focus to the downward rigidity in money wages and prices to explain economic fluctuations. However, if countries having both more flexible wages and prices do not reduce volatility in output growth, this explanation becomes unpersuasive. Easterly, Islam, and Stiglitz (2000) recently found cross-country evidence showing that (i) in terms of bivariate correlation, wage and price flexibility are instead associated with greater variability in growth rates; (ii) in multiple variables analyses, wage flexibility indicators can not significantly enter into output volatility regressions. Noticeably, in the past ten years, aside from the conventional views, the roles of financial markets and institutions in explaining output fluctuations have received increasing attention.

In theory, several seminal papers have tried to model the role played by the financial sector in initiating and propagating economic fluctuations. Suarez and Sussman (1997) present a model showing how financial factors can themselves drive economic fluctuations – even without exogenous shocks. Compared to the endogenous business-cycle models (also see Rajan, 1994), several existing models explore how, given exogenous shocks, financial elements can amplify the effects of shocks and consequently propagate economic fluctuations and economic recessions. This amplifying and propagating mechanism can be either through a bank lending channel (Bernanke and Blinder, 1988; Kashyap, Lamont, and Stein, 1994) or a balance sheet channel (Hubbard, 1998; Bernake and Gertler, 1995; Bernanke et al., 1998). Both endogenous and exogenous models of the finance-fluctuation nexus predict that a more developed financial system could reduce economic fluctuations. In addition, by invoking the concept of the macroeconomic multiplier, Blum and Hellwig (1995) argue in a theoretical paper that capital adequacy requirements have a significant pro-cyclical effect on the real economy. Moreover, Allen and Gale (2000) argue that limited liability induces a "risk-shifting problem" and pro-risk behavior, which lead to higher asset prices and higher chances of default, and thus financial crises and economic recessions. Most of the existing papers, however, focus on how financial intermediaries affect economic fluctuations, rather than on a more complex financial structure with an array of financial contracts. In theory, it is possible that different financial instruments could potentially have distinct effects on economic fluctuations. If this is really true, the overall financial development and financial structure could matter for volatility. Then, merely focusing on financial intermediaries could be misleading.

Although the finance-growth relationship has attracted quite a lot of attention in the past decade (see, for example, King and Levine, 1993; Rajan and Zingales, 1998; Neusser and Kugler, 1998; and Levine, 2002), empirical testing of the finance-fluctuation relationship has only been a recent

effort. Da Silva (2002) finds that more developed credit markets (measured by whether deposit money banks hold more assets relative to the domestic assets of the central bank, and whether non-financial private sectors receive a greater proportion of total domestic credit) exhibit less volatile business cycles because credit institutions become more capable of screening potential borrowers. But she finds that whether the financial structure is more market or bank based does not affect volatility. Denizer, Iyigun, and Owen (2000) find similar results as Da Silva, although they find weak evidence that an economy relying more on the stock market relative to banks exhibits more volatility in consumption; they attribute this relationship to stock market wealth effects. Beck, Lundberg, and Majnoni (2001) cast doubt on previous studies that have found a negative relationship between indicators of financial intermediary development and growth volatility. They argue that whether financial intermediary development dampens or magnifies shocks depends on the types of shocks. Financial development can dampen real shocks, but tends to magnify monetary shocks. On average, an economy is hit by both real and monetary shocks, and the dampening and magnifying effects of financial intermediaries cancel out each other. Most recently, Acemoglu et al. (2002) find that in a cross-country regression, financial development (measured as the ratio of M2 over GDP) has no effects on volatility, after controlling for measures of the quality of institutions. Lopez and Spiegel (2002) find that although financial development does mitigate economic fluctuations in the long run, it may exacerbate short-term volatility in isolated episodes. They suggest that one reason for this discrepancy may be that financial liberalizations are typically only partial, resulting in increased financial market distortions.

The existing empirical literature on the relationship between finance and economic fluctuations has mainly focused on financial intermediary measurements, however, and has paid less attention to whether different financial contract compositions and financial structure matter for fluctuations. In particular, the roles of equity market development and the relative size of equity versus debt on volatility have not yet been empirically tested. If, for example, the role of equity market development in reducing volatility is empirically positive and can dominate credit or even makes credit play the opposite role, then empirical studies only including financial intermediaries in volatility regressions are mis-specified and may result in misleading conclusions. Moreover, since economic downturns are special events, the role played by financial development and financial structure explaining economic downturns is worthwhile to study. Current empirical studies lack, in particular, a focus on the finance-downturn relationship.

This chapter models a particular mechanism describing how financial

structure can matter for economic fluctuations, in general, and economic downturns, in particular. In the model, the financial structure is determined by some key underlying parameters, including state verification cost, a bankruptcy cost, productivity, and the risk-less interest rate. At a firm level, although debt financing is cheaper than equity financing (since debt needs to be verified fewer states), more debt increases the probability of going into costly bankruptcy with firms bearing the bankruptcy cost. Equity financing can instead avoid bankruptcy costs by nature. The advantages and disadvantages of debt vs. equity are balanced by firms when making capital structure choices. At the aggregate level, a more bank-based financial structure leads to a higher proportion of firms going into bankruptcy when certain negative shocks occur, with more bankruptcy costs amplifying the unfavorable situation. As consequences, the variance of production and the possibility and severity of economic downturns are greater in an economy with a bank-based financial structure than in the economy with a market-based structure.

We also test empirically whether countries with a bank-based financial structure have a higher variance of GDP growth and a greater possibility and more severe economic downturns. Controlling for commonly used variables in explaining growth volatility (see, for example, Karras and Song, 1996) and adding credit and equity size indicators simultaneously into regressions, we find that credit variables can not enter into the regression with significant signs, although a non-linear relationship is found when a credit square term is included. Greater credit is associated with less volatility in the GDP growth rate, but only to a certain extent, beyond which the larger financial intermediaries actually serve to magnify the shocks to the economy. Measurements of equity market size (market capitalization) instead present a consistently significant role in reducing GDP growth volatility –regardless of whether or not the credit square term is included. We get the financial structure proxy by taking the ratio of equity market measurements to credit measurements and significantly find that a more market-based financial system is associated with less GDP growth-rate volatility. Moreover, using the Tobit model, we find that the ratio of credit to GDP increases the likelihood and severity of economic downturns, whereas the stock market capitalization ratio decreases the probability and severity of a downturn. The relative size measure, i.e. the financial structure indicator, enters into the Tobit regression with expected signs, suggesting that financial structures that feature debt more prominently than equity are more vulnerable to a growth collapse.

The chapter is organized as follows. Section 3.2 presents the underlying theoretical model. Section 3.3 describes the data and empirical specifications. Section 3.4 presents and interprets the empirical results. Section 3.5 concludes.

3.2 The model

3.2.1 Environment

Entrepreneurs

There are infinitely many entrepreneurs in the economy, indexed by i and with measure of 1. The production function of each entrepreneur has an identical formula:

$$\tilde{y}_i = \eta(\tilde{A}_a + \tilde{A}_{f,i})k \tag{3.1}$$

Two separate of shocks enter into the production function: an economy-wide aggregate shock $\tilde{A}_a$ and a firm-specific shock $\tilde{A}_{f,i}$. Both shocks are identically independently distributed on range [0,1] with uniform distribution. $E(\tilde{A}_a + \tilde{A}_{f,i}) = 1$. Therefore $E(\tilde{y}_i) = \eta k$

Capital k is the major input for production, and η is the capital productivity parameter. Suppose $\eta > 1 + r_0$; thus, $\eta k > (1 + r_0)k$ (r_0 is the riskless interest rate), indicating that capital productivity is large enough that in an expected sense more than gross cost of capital can be produced. The capital productivity parameter η could be attributed to the "ideas" or technologies invested by the entrepreneur into the production process. For the sake of simplicity, we assume each entrepreneur uses a unit amount of capital. Therefore, we disregard capital scale differences among firms. Then, (3.1) can be simplified to

$$\tilde{y}_i = \eta(\tilde{A}_a + \tilde{A}_{f,i}) \tag{3.2}$$

Creditors and non-controlling shareholders

Capital is raised either by borrowing money from creditors or issuing public shares on the stock market. Denote borrowing capital by γ. Since total capital is one unit, γ can be understood both as the proportion and as the total amount of borrowing. The entrepreneur has to give up partial ownership of the firm to get the rest of the capital $1-\gamma$ from the stock market. Suppose a share s of the firm's ownership is given to public shareholders issued at price p per unit. Then,

$$sp = 1 - \gamma \tag{3.3}$$

The financiers (either the creditors or the public shareholders) can not directly observe the realization of the shocks, nor the realized y_i. But the

entrepreneurs, as "insiders", can. In this regard, entrepreneurs are controlling shareholders, whereas public shareholders are non-controlling ones.

Features of debt and equity contracts

Debt and equity contracts differ in two ways. First, debt is a cheaper way of financing than equity. Since financial returns paid by entrepreneurs to financiers are based on reported y_i, both types of financiers have to verify whether entrepreneurs are telling the truth. Verifying the truth is not without cost (Townsend, 1979). In the end, it is the entrepreneurs who have to bear this cost. Due to the unobservability of realized y_i, both ways of financing are costly for entrepreneurs. However, the extent of necessity to verify differs between these two types of contracts. Creditors need to verify only in case of claimed bankruptcy. If no bankruptcy is reported, then creditors do not need to verify, and get a fixed payment. Instead, non-controlling shareholders are supposed to share the realized production proportionately with entrepreneurs no matter what states happen; they thus need to verify the claimed production at all levels (Townsend, 1979). Because owners of publicly held shares need to verify more states than owners of debt, it is reasonable to assume that equity is a more expensive way of financing compared to debt. Assign α_d $(0 \leq \alpha_d \leq 1)$ and α_e $(0 \leq \alpha_e \leq 1)$ as the cost parameters of debt and equity financing respectively, proportionate to the amount of borrowing and equity issuing; then $0 \leq \alpha_d \leq \alpha_e \leq 1$.

Second, debt and equity financing also differ in terms of bankruptcy costs. Bankruptcy is only a concept associated with debt financing. There is no possibility of bankruptcy if a firm is totally financed by equity. When going into bankruptcy there is a cost of β percentage $(0 \leq \beta \leq 1)$ of the total capital. Here, since the total capital input is one unit, β can be understood both as a percentage and an absolute number.

We can understand bankruptcy cost in a broader sense. Not only does it include direct bankruptcy costs (legal, accounting, and other professional fees, reorganization costs, etc.) and indirect bankruptcy costs (loss of key personnel, loss of management time and efforts, lost sales from falling demand as a result of customer concerns over future service difficulties, etc.), but also the costs associated with low efficiency in allocating resources and costly weak corporate control in debt financing recognized by the literature. A country case study by Kang and Stulz (1998) shows that, far from being the promoters of rational investment, Japanese banks impose soft budget constraints, over-lending to declining firms that require radical reorganization. According to Morck and Nakamura (1999), Japanese banks, instead of facilitating governance, collude with enterprise managers to deter external

threats to their control and to prop up troubled bank group firms. Lastly, as a result of the existence of "bankruptcy chains" due to interconnections among firms, the likelihood of bankruptcy can become a variable of systemic concern, and effects of a negative shock on more than one firm may materialize. These negative bankruptcy externalities can also be included into bankruptcy costs in a broad sense, especially from the macroeconomic point of view, even if they are not taken into account by the entrepreneur.

In sum, although debt is cheaper in terms of state verification cost, debt possibly induces a bankruptcy cost that would never happen with only equity.

3.2.2 A firm's capital structure choice problem

Bankruptcy probability

A firm goes into bankruptcy if the realized total production is smaller than the amount of debt owed plus the interest payment; i.e. if $y_i < \gamma(1+r)$, In terms of the random shocks, if

$$(\tilde{A}_a + \tilde{A}_{f,i}) < \frac{\gamma(1+r)}{\eta} \tag{3.4}$$

a firm goes into bankruptcy. Here, r is the interest rate charged by creditors, which will be endogenously determined later.

The probability of going into bankruptcy is

$$P = P(y_i < \gamma(1+r)) = P(\eta(\tilde{A}_a + \tilde{A}_{f,i}) < \gamma(1+r)) = \frac{\gamma^2(1+r)^2}{2\eta^2} \tag{3.5}$$

Notice that the sum of two uniformly distributed random variables $\tilde{A}$ ($\tilde{A} = \tilde{A}_a + \tilde{A}_{f,i}$) has the density function:

$$f(\tilde{A}) = \tilde{A} \ (if \ 0 \leqq \tilde{A} \leqq 1)$$

$$f(\tilde{A}) = (2 - \tilde{A}) \ (if \ 1 < \tilde{A} \leqq 2)$$

By assuming $\frac{\gamma(1+r)}{\eta} < 1$[1], we get (3.5).

[1]The limitation among underlying parameters to ensures this inequality will be presented in section 3.2.3.

Returns

When a firm goes into bankruptcy, shareholders (both controlling and non-controlling shareholders) get nothing. Only when shocks are positive enough, as stated in (3.4), can shareholders get the return after a fixed payment to the creditors. Therefore, the total expected return to all shareholders is $\int_{\frac{\gamma(1+r)}{\eta}}^{2}(\eta\tilde{A}-\gamma(1+r))f(\tilde{A})d\tilde{A}$. Since the entrepreneur gives up partial ownership to public shareholders, the entrepreneur's part of return is

$$R=(1-s)\int_{\frac{\gamma(1+r)}{\eta}}^{2}(\eta\tilde{A}-\gamma(1+r))f(\tilde{A})d\tilde{A} \tag{3.6}$$

corresponding to her share of ownership $1-s$.

Assume that public shareholders are risk neutral. Their no arbitrary condition requires that

$$s\int_{\frac{\gamma(1+r)}{\eta}}^{2}(\eta\tilde{A}-\gamma(1+r))f(\tilde{A})d\tilde{A}-(1-\gamma)\alpha_e=(1-\gamma)(1+r_0) \tag{3.7}$$

Similarly assume the creditors are risk neutral. Their no arbitrary condition requires that

$$\int_{0}^{\frac{\gamma(1+r)}{\eta}}\eta\tilde{A}f(\tilde{A})d\tilde{A}+\gamma(1+r)\int_{\frac{\gamma(1+r)}{\eta}}^{2}f(\tilde{A})d\tilde{A}-\gamma\alpha_d-\beta P=\gamma(1+r_0) \tag{3.8}$$

These two no arbitrary conditions basically says that the expected return of non-controlling shareholders and creditors by investing capital to entrepreneurs' project is the same as the return by investing into the riskless asset.

By (3.3), (3.7) and (3.8), we get

$$s=\frac{(1-\gamma)(1+r_0+\alpha_e)}{\eta-\gamma(1+r_0+\alpha_d)-\beta P} \tag{3.9}$$

Plugging (3.9) into (3.6), the expected return of the entrepreneur is

$$R=(1-s)\int_{\frac{\gamma(1+r)}{\eta}}^{2}(\eta\tilde{A}-\gamma(1+r))f(\tilde{A})d\tilde{A}=\eta-(1+r_0)-(1-\gamma)\alpha_e-\gamma\alpha_d-\beta P \tag{3.10}$$

The entrepreneur's capital structure choice problem

The entrepreneur problem is to choose γ to

$$Maximize\ \eta - (1 + r_0) - \alpha_d\gamma - \alpha_e(1 - \gamma) - \beta P$$

$$subject\ to\ (i)\ 0 \leq \gamma \leq 1;$$

$$(ii)\ \int_0^{\frac{\gamma(1+r)}{\eta}} \eta\tilde{A}f(\tilde{A})d\tilde{A} + \gamma(1 + r)\int_{\frac{\gamma(1+r)}{\eta}}^{2} f(\tilde{A})d\tilde{A} - \gamma\alpha_d - \beta P = \gamma(1 + r_0)$$

The constraint (i) is the normal boundary constraint. Constraint (ii) is the creditors' no arbitrage condition. Plugging in (3.5) and simplifying constraint (ii) under the assumption that $\frac{\gamma(1+r)}{\eta} < 1$,we get

$$r - r_0 = \frac{\gamma^2(1 + r)^3}{6\eta^2} + \alpha_d + \beta\frac{\gamma(1 + r)^2}{2\eta^2} \tag{3.11}$$

Examining this equation, we find three reasons why interest rate charged by creditors is higher than the risk-free interest rate: to compensate the low returns in the states of bankruptcy; to compensate the monitoring activity; to compensate the cost arising from bankruptcy.

Entrepreneurs maximizing the return is equivalent to their minimizing the cost of capital. Therefore, the entrepreneur's problem is simplified to choose γ in order to (plug in (3.5))

$$Minimize\ \alpha_d\gamma + \alpha_e(1 - \gamma) + \beta\frac{\gamma^2(1 + r)^2}{2\eta^2}$$

$$subject\ to\ (i).\ 0 \leq \gamma \leq 1$$

$$(ii).\ r - r_0 = \frac{\gamma^2(1 + r)^3}{6\eta^2} + \alpha_d + \beta\frac{\gamma(1 + r)^2}{2\eta^2}$$

The solution of this problem is stated in appendix.

Static analyses of γ^*

Examining the optimal capital structure choice, γ^*, we get the following proposition.

Proposition 3.1 *Higher bankruptcy costs lead to a lower level of debt; a greater difference between the costs associated with state verification of equity and debt leads to a higher level of debt; higher productivity gives rise to a higher level of debt; and a higher riskless interest rate give rises to a lower level of debt.*

Proof. *see appendix.* ■

This proposition characterizes how the optimal debt level is determined within a firm. Higher bankruptcy costs make the debt more costly (thus less attractive) and reduce the optimal leverage. The less expensive the equity financing associated with state verification is, the less the cost advantages of debt are, and the less attractive the debt financing is, and hence the smaller leverage is. Given other factors, higher productivity transforms the same amount of capital into more output, reducing the chance of insufficiency of output for paying debt back, tending to increase leverage. Lastly, a lower riskless interest rate reduces the capital costs of debt more than those of equity, leading to increased leverage.

Identical firms make the same decisions. Therefore, at the macro level, the financial structure of this economy can be measured by $\theta = \frac{1-\gamma}{\gamma}$. By definition, a higher θ corresponds to a market-based financial structure. Intuitively, proposition 3.1 tells us that an economy with high bankruptcy costs, relatively cheaper equity, low productivity, and a high riskless interest rate tends to have a market-based financial structure.

3.2.3 Aggregate problem

Proportion of bankrupted firms

Before the shocks are realized, each firm makes a capital structure decision based on the knowledge of the distributions of the sum of two shocks. After this decision has been made, both firm-specific shocks and aggregate shocks are realized. Given the aggregate shock $\tilde{A}_a = A_a$, the probability of anyone firm going into bankruptcy is

$$P_{A_a} = P(\eta(A_a+\tilde{A}_{f,i}) < \gamma(1+r)) = P(\tilde{A}_{f,i} < \frac{\gamma(1+r)}{\eta} - A_a) = \frac{\gamma(1+r)}{\eta} - A_a \tag{3.12}$$

$\frac{\gamma(1+r)}{\eta}$ can be calculated by plugging in the expressions for γ and r.

$$\frac{\gamma(1+r)}{\eta} = \frac{1}{(\alpha_e - \alpha_d)\eta}(\sqrt{2(\alpha_e - \alpha_d)^2\eta^2 + \beta^2(1+r_0+\alpha_d)^2} - \beta(1+r_0+\alpha_d)) \tag{3.13}$$

It is obvious that $0 < \frac{\gamma(1+r)}{\eta} < 2$.Throughout the calculation, we assume $\frac{\gamma(1+r)}{\eta} < 1$. We see that if

$$(\alpha_e - \alpha_d)\eta < 2\beta(1+r_0+\alpha_d), \tag{3.14}$$

$\frac{\gamma(1+r)}{\eta} < 1$ holds.

Since there are infinitely many identical firms, the proportion of firms going into bankruptcy is the same as the probability of one firm going into bankruptcy. Depending on how large the realized aggregate shocks are, two types of situations exist.

A "good situation" happens when $\frac{\gamma(1+r)}{\eta} \leqq A_a \leqq 1$. In this range of aggregate shocks, the aggregate shocks are sufficiently large that even firms facing the worst possible firm-specific shock ($A_{f,i} = 0$) will not go into bankruptcy. Since A_a has uniform distribution the probability of a "good situation" is $1 - \frac{\gamma(1+r)}{\eta}$.

A "bad situation" happens when the realized aggregate shocks are small: i.e., $0 \leqq A_a < \frac{\gamma(1+r)}{\eta}$. In this situation, bankruptcy is inevitable. The probability of having a "bad situation" is $\frac{\gamma(1+r)}{\eta}$. Further, $\frac{\gamma(1+r)}{\eta} - A_a$ is the proportion of firms going into bankruptcy. The lower the aggregate shock, the higher the proportion of the firms that go into bankruptcy. The highest proportion of firms going into bankruptcy is $\frac{\gamma(1+r)}{\eta}$ when $A_a = 0$.

Aggregate production

Aggregate production net of state verification costs (and bankruptcy costs) in these two situations is

1. Good situation: $Y_G = (A_a + 0.5)\eta - (1+r_0) - \alpha_d\gamma - \alpha_e(1-\gamma)$.
2. Bad situation: $Y_B = (A_a+0.5)\eta - (1+r_0) - \alpha_d\gamma - \alpha_e(1-\gamma) - (\frac{\gamma(1+r)}{\eta} - A_a)\beta$.

Hereby, 0.5 comes from the law of large numbers (i.e., at the aggregate level, the firm-specific shocks approach their expectations).

3.2.4 Macroeconomic downturns

How aggregate production changes with the aggregate shock can be shown in Figure 3.1, as indicated by the right-up sloped line with a kink at M. The sub-line to the left of point M corresponds to Y_B, which is steeper than the sub-line corresponding to Y_G, which is to the right of point M (Slope $\eta + \beta > \eta$). This shape of the line captures the following idea. Not only do the unfavorable aggregate shocks negatively affect the aggregate production (indicated by the right-up slope of the line), but also the bankruptcy costs reduce the aggregate production further, amplifying the negative effects of unfavorable shocks (indicated by the two sublines). When unfavorable shocks get larger, more firms go into bankruptcy and the amplification effects become larger as well. In the extreme, when $A_a = 0$, the maximal amplification effect occurs, which corresponds to the difference of these two sublines' intercepts on Y axis, measured by $\frac{\gamma(1+r)}{\eta}\beta$. We call it as the "bankruptcy-induced downturn amplification mechanism".

We define the vertical projection of M (point N in the figure, which is $\frac{\gamma(1+r)}{\eta}$ far from O) as "cutting point" since this point divides the "Good situation" from the "Bad situation". Noticeably, as shown in the figure the change of $\frac{\gamma(1+r)}{\eta}$ has double effects. First, bigger $\frac{\gamma(1+r)}{\eta}$ (N moves away from O) leads to a higher probability of the "Bad situation" happening. Second, given that the aggregate shocks are in the "bad" range, bigger $\frac{\gamma(1+r)}{\eta}$ increases the proportion of the firms going into bankruptcy. Therefore, bigger $\frac{\gamma(1+r)}{\eta}$ not only increases the probability of a "Bad situation", but also increases the extent to which the downturn is amplified.

$\frac{\gamma(1+r)}{\eta}$ is determined by underlying parameters (see (3.13)). We can get the following proposition stating the relationship between underlying parameters and $\frac{\gamma(1+r)}{\eta}$. This proposition is specifically about the position of the cutting point in Figure 3.

Proposition 3.2 *Higher bankruptcy costs lead to a smaller cutting point; higher differences between the state verification costs of equity and debt lead to a bigger cutting point; higher productivity gives rise to a bigger cutting point; and a higher non-risk interest rate gives rise to a smaller cutting point.*

Proof. *see appendix.* ■

A comparison of Propositions 3.1 and 3.2 reveals that γ and $\frac{\gamma(1+r)}{\eta}$ move in the same direction when underlying parameters change. Because γ indicates to what extent the economy has a bank-based financial structure, and $\frac{\gamma(1+r)}{\eta}$ measures the probability and indicates the magnitude of an amplified downturn, propositions 3.1 and 3.2 together tell us that a bank-based financial

system gives rise to a higher probability of an amplified economic downturn and a more significant amplified downturn if downturn occurs. This is a directly testable hypothesis.

3.2.5 Aggregate output variance

This subsection uses graphs to show how the changes of underlying parameters can affect the variances of output. All of the analyses can be proved in a more rigorous way, but simple graphs also work well.

Change of bankruptcy costs

Figure 3.1 shows the effects of increasing bankruptcy costs on output volatility. There are three effects. First, increased bankruptcy cost make debt financing less advantageous. A shift of financing from debt to equity increases the total state verification costs, and thus lowers the total output everywhere. In the Figure, the dotted line is below the straight line. Second, increased bankruptcy costs reduce $\frac{\gamma(1+r)}{\eta}$ (move from N to N'),and thus increase the possibility of a "Good situation" and reduce the variance of output. Third, the increase of β means that the cost per bankruptcy increases. Therefore, the production line in "Bad situations" becomes steeper, increasing the variance of production. In sum, when bankruptcy costs become higher, the change of the variance of output is ambiguous.

Change of relative costs associated with state verification

Figure 3.2 shows how the output changes if equity becomes relatively more expensive. First, more expensive equity increases reliance on cheaper debt, increasing the level of production. In this figure, the dotted line is above the straight line. Second, relatively expensive equity financing increases the cutting point from N to N', thus decreasing the possibility of a "Good situation". Because the straight and dotted lines parallel each other, and the steeper part of the dotted line becomes "longer" after the cost change, the variance of production will increase.

Change of the productivity parameter

Figure 3.3 shows how output changes when the productivity parameter increases. First, higher productivity will increase reliance on debt, since an individual firm's bankruptcy probability goes down. The level of production will therefore increase. Second, when increasing productivity, both parts of the dotted production line become steeper, but since the cutting point moves

to the right the even steeper line becomes "longer". Therefore, the variance of production goes up.

Change of the riskless interest rate

Figure 3.4 shows how production changes when the riskless interest rate increases. First, higher interest rate reduces the level of production because it shifts the capital structure towards the more expensive way of financing. Second, when increasing the riskless interest rate, both parts of the production line are parallel with the original ones, but since the cutting point moves to the left, the steeper line becomes "shorter". Therefore, the variance of production goes down.

Table 3.1 summarizes the analyses in subsections 3.2.4 and 3.2.5 of the relationships between underlying parameters, financial structure, output variance, and economic downturn.

Table 3.1: Theoretical Summery: relationships between underlying parameters, financial structure, variances of output, and probability and severity of economic downturn

	Financial structure	Variance of GDP	Economic downturn
$\beta \downarrow$	more bank based	undetermined	higher probability, more severe
$(\alpha_e - \alpha_d) \uparrow$	more bank based	$\uparrow$	higher probability
$r_0 \downarrow$	more bank based	$\uparrow$	higher probability
$\eta \uparrow$	more bank based	$\uparrow$	higher probability

It is hard to observe underlying parameters, such as bankruptcy cost, etc. What we can easily observe is the absolute and relative sizes of credit and equity markets. The model predicts that (1) A bank-based financial structure has a higher probability of a "bad situation", and a greater amplified downturn if that happens; (2) A bank-based financial structure tend to have higher variances of output, although the effects of lower bankruptcy costs on the variance of output is ambiguous. The remaining part of the chapter tests these predictions.

3.3 Data and empirical specifications

3.3.1 Data

The data analyzed in this study cover 175 countries from 1960 to 2002 at the longest. Two sources of data are combined: the World Development

Indicators (WDI, 2003) for GDP growth rate and various control variables, and Beck, Demirguc-Kunt and Levine (2000) data for domestic financial variables[2]. The ending year of the available financial data from Beck et al.'s dataset is 1997. Detailed variable definitions and data sources are provided in appendix.

Growth rate variables

Annual GDP per capita growth rates are from the WDI data set. We use a simple and straightforward method to get the measure of economic volatility, which is the dependent variable: the standard deviation of annual growth rate over a certain period[3], namely *sd_GDPg*. We also construct an annual *Downturn* variable from GDP growth-rate data, as an alternative dependent variable, defined later.

Financial development and structure variables

Two variables are used as measures of domestic credit and equity market size, respectively. They are *CredPriv* (Claims on private sector by deposit money banks as a share of GDP) and *Mcap* (Stock market capitalization as a share of GDP). *CredPriv* measures the size activity of the financial intermediary sector, channelling funds to investors in the private sector. Thus, it excludes credits to governments, state-owned enterprises, and cross claims on other financial intermediaries. Furthermore, it includes credits not only by deposit banks, but also by other financial intermediaries, such as finance companies and life insurance companies. *Mcap* measures the size of the stock market relative to GDP. There are alternative variables measuring financial development commonly used in the empirical literature, such as the ratio of the assets of deposit money banks to the sum of the assets of deposit money banks and the central bank, the ratio of the claims to the non-financial private sector divided by the total domestic credit, stock market total value

[2] WDI also contains domestic financial data. But the starting year for the available data is much later than Beck, Demirguc-Kunt and Levine's and they lacks information on other financial data except credit and equity. Moreover, there are minor differences among the financial variables both contained in the two data sets. That Beck, Demirguc-Kunt and Levine's data are more widely used and supposed to be more reliable provides us another reason to use their financial data.

[3] There are several ways to extract the business cycle component of the output, such as linear detrending, first difference, moving average, HP filter, and the most recently BP filter. First difference is simple and suitable for data of difference stationary. Logarithm of GDP per capita is regarded difference stationary. Therefore, first difference of logarithm of annual GDP per capita (approximately equal to GDP per capita annual growth rate) is used here as the way of detrending.

traded, stock market turnover ratio, etc. However, the efficiency, liquidity, and structure (except credit vs. equity) of the financial system is not emphasized by the theoretical model developed in section 3.2. Instead, the model mainly describes how the absolute and relative size of the credit and equity contract may matter for economic volatility and downturn. Corresponding to the model, we only apply size measurements in the regressions.

To consider the widest range of financial instruments possible, we also use two other size indicators of financial development: *PriBonCap* (Private bond market capitalization to GDP) and *LongPriDe* (Long-term Private Debt Issues to GDP), both from Beck et al.'s data set. To classify these variables properly, we recall the model in section 3.2, which actually focuses on the mechanism of which bankruptcy costs associated with a credit contract can amplify an economic downturn. To reflect this, we regard these financial instruments as closer to equity than to the credit contract because they are either tradeable or have a long time maturity, making the issuers suffer less from bankruptcy. The mechanism emphasized by the model is therefore less workable for these financial instruments. The summation of *Mcap, PriBonCap,* and *LongPriDe* is referred to as *Capital*.

Noticeably, there is no one-to-one relationship between financial structure and financial development. All of the measures of financial development can be dramatically different among countries with a similar financial structure; countries in similar phase of financial development can have quite different financial structures (Stulz, 1999). For example, Japan and the U.S. have a similar level of financial development, yet different financial structures; Mexico and the Netherlands have a similar financial structure, yet quite a different degree of financial development (Tadesse, 2001). It is therefore necessary to distinguish financial structure from financial development. In the chapter, apart from the size indicators of credit and equity showing the degree of financial development of a particular country in time, we also calculate a proxy to show the relative importance of these two ways of financing, namely *Struc.* It is defined as stock market capitalization divided by private sector claims of deposit banks(*Mcap/CredPriv).* Larger *Struc* indicates that an equity contract is relatively more important in the country. If we define a market-based financial system as one that relies more on equity contracts, we can say that a country with a higher *Struc* variable has a more market-based financial system.

Instrumental variables

A set of instrumental variables is used to control for the possibility that both the financial structure and the degree of growth volatility are being caused

by third factors. The "law and finance" literature (see La Porta, Rafael et al., 1997, 1998, for a general discussion, and Modigliani and Perotti, 1997, for security markets, in particular) could help us to find instrumental variables explaining financial structure but not growth rate volatility. The basic message in this area of literature is as follows. A good legal environment protects potential financiers against expropriation by the managers and entrepreneurs. The cost for entrepreneurs of raising capital from outside financiers, either by equity or by debt, therefore will be lower, the more protection of the outsiders' rights is offered by the law itself and by the enforceability of the law. As a consequence, the width, depth, and scope of the financial system will be more expanded in a better legal environment. Although the "law and finance" literature focuses more on the law effects on the overall financial development, we can apply them to explain the financial structural differences as well. Here, the financial structure is once more defined as the relative importance of the equity vs. credit contract.

First, a natural hypothesis is that an economy with greater shareholders' rights protection will possess a more market-based financial structure[4]. Secondly, the degree of law enforceability could influence the financial structure in either direction, depending on which way of financing generates, by nature, potentially more conflicts of interests between insiders and outsiders. Thirdly, as argued in the theoretical model, one reason why equity contracts are more expensive than debt contracts is that equity contracts need more states to be verified. Therefore, if the general information disclosure standards in a country are more strict, then the cost difference between debt and equity is expected to be smaller, equity could be relatively cheap, and the financial structure could be more market based.

To reflect these three considerations, we choose *Srights* (Minority shareholders' rights), *Crights* (Creditor rights), and *Law* (Rule of law) as proxies for shareholders' rights protection, creditors' rights protection, and law enforceability, to explain cross-country differences in financial structures. We additionally include *Account* (Accounting standards) as a measurement for the strictness of information disclosure, and expect that a higher standard of accounting is associated with a more market-based financial structure. All these indicators are found in La Porta, Lopez-de-Silanes, Shleifer, Vishny (1998).

Finally, the theoretical model shows that the financial structure is determined by the following underlying parameters: the cost difference between

[4]La Porta, et al. (1998) also shows that (1) the United States is actually one of the most anticreditor common-law countries; (2). German-civil-law countries are protective of secured creditors and generally not of shareholders.

equity and debt financing, bankruptcy costs, the riskless interest rate, and the productivity parameter. In principle, all of these could be used as explanatory variables for financial structure. However, in order to be used as instrumental variables, they also need to be exogenous of growth volatility. Theoretically, it is not clear whether the riskless interest rate and the productivity parameter are exogenous of growth rate. So we are reluctant to choose them as instrumental variables. Moreover, since it is hard to get cross-country data on bankruptcy costs, it is not yet feasible for us to use bankruptcy cost as one of the instrumental variables. In the chapter, we use only the above-mentioned legal variables, all more or less actually related to the state verification cost difference between equity and debt financing, as instrumental variables for financial structure.

Controlling variables

In addition to the instrumental variables, other variables usually considered to be determinants of the volatility of economic activity are also included in the regressions.

Two variables control for the monetary and fiscal aspects of the economy. Controlling for the effects of monetary policy, *Inflation* (defined as the average annual rate of change of the GDP deflator) shows the rate of price change in the economy as a whole. We do not use direct measures of monetary policy, like the level of M1, M2, or the standard deviations of M1 and M2 growth rates, etc., either because the levels of M1 and M2 are significantly correlated with *CrediPriv*, or because the standard deviations of M1 growth rate and M2 growth rate are subject to severe endogenity problems. *Gov_ consump,* the General government final consumption expenditure (as a percentage of GDP), is used to test whether government size has any stabilizing effects.

The openness of the country, both economically and financially, also can potentially influence the volatility of economic activity. Thus, this study includes the following two variables indicating the degree of one country's connection with the rest of the world. *Trade* is the sum of exports and imports of goods and services as a percentage of GDP, measuring the strength of external economic links. *PrivCapFlow* refers to the net capital flows (both debt and non-debt flows) as a percentage of GDP, capturing the financial aspect of a country's connection with the rest of the world.

Moreover, since the change of exchange rate could be understood as a kind of external shock influencing GDP volatility, we include *e_ change (*the absolute value of real effective exchange rate change in percentage) to take this into consideration.

Finally, we also include *OECD* (equal to 1 if the country is an OECD

member country[5]) to capture other non-controlled fixed factors related to development stages that could affect growth volatility, such as industrial structure, institutions, etc.

Table 3.2 provides summary statistics for all data in the study.

3.3.2 Empirical specifications

To test how financial development and structure can affect economic volatility and downturns, we run two types of regressions, one for explaining the standard deviation of GDP per capita growth rate, and one for explaining the probability and degree of economic downturns, by using an array of financial variables and control variables as independent variables.

To explain growth rate volatility, we use two specifications:

$$(sd\_GDPg\_pc)_{i,t} = \beta_0 + \beta_1 X_{1,i,t} + \beta_2 X_{2,i,t} + ... \beta_n X_{n,i,t} + \alpha_1 Credit_{i,t} + \alpha_2 Equity_{i,t} + \epsilon_{i,t} \tag{3.15}$$

$$(sd\_GDPg\_pc)_{i,t} = \beta_0 + \beta_1 X_{1,i,t} + \beta_2 X_{2,i,t} + ... \beta_n X_{n,i,t} + \alpha_1 Struc_{i,t} + \epsilon_{i,t} \tag{3.16}$$

X_1 to X_n are n control variables, as listed above. $Credit_{i,t}$ and $Equity_{i,t}$ are credit and equity market development indicators, and $Struc$ is a proxy indicating a particular country's financial structure. Subscript i denotes the country identity, and t is the period over which variables are collapsed either in terms of standard deviation (for the GDP growth rate and net capital flows) or in terms of mean value (for the rest). The broadest time span of our data is between 1960 and 2002. We construct three data sets according to the number of periods into which the data are divided. We first calculate the corresponding mean and standard deviations of certain variables over the entire period, thereby obtaining a cross-country data set with one observation for each country. We also divide the entire period into two sub-periods: 1960 to 1981 and 1982 to 2002, thereby obtaining a panel with two time-period dimensions. Three periods are constructed as well, with 1974, 1988 and 2002 as ending years. An ideal characterization of the amplitude of the GDP growth volatility in each country and each time period would require a large

[5]We use the latest OECD member country list including the following 30 countries: Australia, Austria, Belgium, Canada, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Japan, Korea, Rep., Luxembourg, Mexico, Netherlands, New Zealand, Norway, Poland, Portugal, Slovak Republic, Spain, Sweden, Switzerland, Turkey, United Kingdom, United States.

number of annual observations. However, we face a trade-off: as we increase the number of years in each period, perhaps increasing the accuracy with which we characterize volatility, we reduce the number of periods we can use in estimation, thereby reducing estimation efficiency. We use these three ways of collapsing the data to take this trade-off into consideration. In addition, we can check whether the regression results are sensitive to period divisions.

Our theoretical model mainly captures the amplification effects of financial factors on economic downturns. Expressed differently: rather than symmetrically studying how economic booms and recessions can be amplified by financial factors, the model instead focuses on how economic downturns can be propagated due to bankruptcy costs and generally the relative cost of debt finance. This leads us to consider two other specifications in order to more directly test this one-sided focused theory.

$$Downturn_{i,t} = \beta_0 + \beta_1 X_{1,i,t} + \beta_2 X_{2,i,t} + ... \beta_n X_{n,i,t} + \alpha_1 Credit_{i,t} + \alpha_2 Equity_{i,t} + \epsilon_{i,t} \tag{3.17}$$

$$Downturn_{i,t} = \beta_0 + \beta_1 X_{1,i,t} + \beta_2 X_{2,i,t} + ... \beta_n X_{n,i,t} + \alpha_1 Struc_{i,t} + \epsilon_{i,t} \tag{3.18}$$

Here $Downturn_{i,t} = 0$, if $GDPg\_pc_{i,t} \geq 0$; $Downturn_{i,t} = GDPg\_pc_{i,t}$,if $GDPg\_pc_{i,t} < 0$, i.e., we set the values of the dependent variable to zero for a non-negative growth rate and keep the original numbers for negative growth rates. Among all of our observations, approximately 19.90% have a negative growth rate. We thus, in fact, create a censored data set. We use a Tobit model for estimations.

3.4 Empirical results

This section presents two sets of regression results. First, we examine how financial variables can influence growth rate volatility. We employ three ways of measuring time periods and use credit and equity variables separately or equity divided by credit as explanatory variables. Secondly, we consider the effects of financial development and structure on the probability and extent of economic downturns. For this purpose, we do not collapse data over years. Instead, we run regressions on annual panel data directly. Similar to our approach to growth rate variance regressions, we use the absolute and relative size of equity and credit development as explanatory variables, respectively, checking their roles in accounting for economic downturns.

In cross-country growth-rate volatility regressions, we use robust standard error methods to correct for possible cross-country heteroscedasticity and autocorrelation. Fixed or random effects panel-data techniques could be used for growth-rate volatility regressions with two or three time periods. Nevertheless, note that the panel-data estimators are asymptotically normal as $T \to \infty$. In small samples, especially when the number of groups exceeds the number of periods, the panel-data estimators yield overly optimistic standard errors, and lead to overconfidence of the results. Therefore, rather than fixed or random effects panel-data techniques, FGLS methods is applied for these two classes of panel regressions, allowing for possible heteroscedasticity across country panels and autocorrelation over time (specifically, we assume AR(1) autocorrelation) within a panel. Tobit estimation methods are applied when economic downturns are to be explained.

3.4.1 Finance and GDP growth-rate volatility

Aggregating time dimensions differently, Tables 3.3, 3.5 and 3.6 present the results on how finance can impact growth-rate volatility. All of these regressions are based on specifications (3.15) and (3.16).

Table 3.3 shows the cross-section regression results: A1 includes credit and equity indicators separately and simultaneously; A2 additionally contains a credit term squared; A3 replaces equity indicators with the equity plus capitalization ratio to GDP of private bonds and long-term debt; and B uses the relative size measure of equity vs. credit. Since *Mcap* always enters into regression with negative significant signs no matter whether *CredPriv(square)* is included, we can say that a bigger stock market (measured by market capitalization) is conducive to reducing growth-rate volatility.

As shown in A1, *CredPriv* itself can not significantly affect growth-rate volatility; this seeming insignificance of credit variables is probably due to non-linearity effects, however. This guess is verified in A2 when *CredPriv (square)* is added to the regression. A larger credit market is associated with less volatility, but only to a certain extent– a credit market that is very large will increase growth-rate volatility[6].

[6]One explanation of the non-linearity is suggested by the ambiguous effects of bankruptcy cost on variance of output as shown in section 3.2. If in the range of relative high bankruptcy cost, "steeper effect" dominates "good situation effect", and vice versa for the range of relative low bankruptcy cost, decrease of bankruptcy cost in the range of relative high bankruptcy cost (therefore more credit) will decrease output volatility, and vice versa for the case of decreasing bankruptcy cost in the range of relative low bankruptcy cost. Therefore we can observe that more credit is reducing volatility of output only to a certain extent. Another explanation is suggested by Beck, et. al. (2001). If rich countries suffer

By replacing *Mcap* with *Capital* and running first regressions of A1 and A2, regressions in A3 aim at checking whether equity financing in a broad sense plays a similar role as equity in a narrow sense. Indeed, we find that *Capital* can still significantly reduce growth-rate volatility, although the non-linearity effects of *CredPriv* disappear. Results of Table 3.A3 confirm to a certain extent our treatment of private bonds and long-term debt as quasi-equity, based on the argument that the issuers of these financial instruments risk a lower chance of paying bankruptcy costs.

Struc enters significantly into three out of four regressions in B, showing that a market based financial system is beneficial for reducing growth volatility. Therefore, not only the absolute sizes of equity and credit matter for growth volatility, but also their relative size.

By adding different combinations of various control variables, Table 3.3's results also point out how other economic factors affect growth volatility. First, a high percentage of government consumption relative to GDP is associated with increased growth-rate volatility, implying that the relative size of government consumption is destabilizing rather than stabilizing volatility. This could be due to the fact that discretionary government spending is subject to long lags, leading to its destabilizing effects. Secondly, *Trade* enters into the regressions (1) of A1, A2, and B with positive signs. These show that although (theoretically speaking) a more open economy may have greater opportunities to export domestic shocks abroad, the heightened exposure to external shocks dominates this effect, and openness effects on net are to increase volatility. Noticeably, the effects of *Trade* become insignificant when more control variables are included, as in (2), (3), and (4) of A1, A2, and B. However, since the sample size changes over different combinations of control variables, (1) and (2), (3), (4) are not very comparable. *OECD* dummy can always enter into regressions with negative signs in all regressions in Table 3.3, which is intuitively reasonable: on average, OECD countries, as mature economies, have less volatile growth rates compared to non-OECD countries. Moreover, high volatile net private capital flows are associated with a high volatility of growth rate. Countries with higher inflation rates have a more volatile growth. Probably one reason is that higher inflation could signal active discretionary monetary policies, which is usually believed to be destabilizing by monetarists. Lastly, the average absolute value of the annual real exchange rate change enters significantly with positive sign into two out of three of the regressions numbered as (4) in A1, A2, and B,

monetary shocks more than real shocks and vice versa for poor countries, non-linearity between credit size and volatility is simply the reflection of rich countries tend to have more advanced credit market development than poor countries.

indicating the destabilizing effects of real exchange rate instability.

To account for the possibility that both financial structure and growth volatility are being caused by third variables, Table 3.4 chooses some legal instrumental variables to extract the exogenous components of financial structure, examining whether these exogenous components still play similar roles. Table 3.4A takes *Struc* as a dependent variable to see how legal and other variables could explain to what extent a country is market based or bank based. In all four specifications, *Srights (*measuring to what extent minority shareholders are protected by rules and laws) presents significantly positive signs, which is consistent with our expectations. Moreover, higher accounting standards and better accounting practice, as information contained in *Account,* enter into regressions with positive signs. One explanation of this result could be that a market-based system requires more pieces of information to be disclosed and more accurate information to be revealed compared to a bank-based system. *Law* and *Crights* can't significantly enter into these regressions – probably because *Srights* and *Account* indicators already reflect information contained in these two variables. Due to data limitations on *Srights* and *Account* (when they are chosen as IV variables for *Struc)* the analogous regression as in Table 3.3B (1) only has 39 observations. For the sake of comparison, we restrict ourselves to these 39 observations and run two regressions: one with IV and one without. The results are shown in Table 3.4B. Using IV methods yields the expected sign of *Struc* with significance, whereas not using IV results in the interested variable *Struc* being not significant. It is therefore the exogenous component of *Struc* that explains the change of growth rate volatility. In this respect, IV improves the regressions.

Table 3.5 presents the results for two-time-period panel regressions, and Table 3.6 shows the results for three time periods. The number of observations in all regressions increases correspondingly. In terms of the coefficients' signs and significancy, these two panel regressions obtain results similar to those in cross-section regressions (except for some minor differences). Regarding financial variables, for example, equity is conducive to reducing growth rate volatility, whereas credit is so only to a certain extent[7]. In terms of relative size of equity vs debt, a market-based system is better at reducing growth volatility. The consistency of panel results with that of cross-section further supports the conclusion of our empirical analyses on the relationship between finance and volatility.

[7]Replacing *Mcap* with *Capital* in these panel regressions, the results of cross section remain.

3.4.2 Finance and economic downturns

By assigning zero to a non-negative growth rate, and keeping the original values of negative growth rates, we create a censored panel data set. The regressions of *Downturn,* the "censored" dependent variables, on financial development and structure indicators are based on specifications (3.17) and (3.18).

Table 3.7A presents the results on the basis of (3.17). As shown in A1, *CredPriv* significantly enters into the regression with a negative sign, and *Mcap* with a positive sign among all combinations of controlling variables. These results strongly imply that larger credit to private sectors relative to GDP actually increases the probability of having negative growth and the severity of a downturn happening[8] (and vice versa for larger stock market capitalization relative to GDP). A2 adds a credit square term into the regressions. We find that the credit square term is not always significant, and that *CredPriv* and *Mcap* keep the same results as when the credit square term is not included, although the significance of *CredPriv* decreases a bit.

Comparing Table 3.7A's results with those in Tables 3A, 5A, and 6A with growth rate volatility as a dependent variable, we get the same mitigating effects of equity development on growth-rate volatility as on economic downturns. The nature of the effects of credit development on volatility and downturn are different, however. Non-linearity impacts of credit size on growth-rate volatility can't be found in the downturn regressions. Instead, we find an amplifying linear effect of credit size on downturns. This is more or less consistent with the predictions of the theoretical model elaborated in section 3.2.

Control variables in Table 3.7A impact the probability and severity of economic downturn in a similar direction to those on volatility as presented in Tables 3.3A, 3.5A, and 3.6A. Larger government consumption increases the probability and the degree of a negative growth rate. Openness, measured by *Trade*, can't significantly influence the possibility and severity of economic downturns. OECD countries, on average, suffer fewer and smaller downturns. Moreover, the net positive private capital flows increase the probability and severity of downturns. Finally, a higher inflation rate and a larger absolute real exchange rate change are both associated with a higher probability and a more severe downturn.

[8]The estimated parameters of Tobit model have a double interpretation: one as the impact of a change in independent variable on the probability of having non-zero dependent values, and one as the impact of a change in independent variable on the level of the non-zero dependent variable. Both effects automatically have the same sign (see Verbeek, Chapter 7).

Table 3.7B presents the results on the basis of specification (3.18). Because *CredPriv* and *Mcap* enter into downturn regressions simultaneously with negative and positive signs, respectively, it is not surprising that *Struc* (constructed by dividing *Mcap* with *CredPriv*) can significantly enter into downturn regressions with a positive sign (as shown in Table 3.7B). This implies that relatively more equity financing will decrease the probability and severity of economic downturns. Other control variables have similar effects and interpretations as in Table 3.7A.

Throughout the regressions in Table 3.7, we add another control variable, *mv5_GDPg*, which is the moving average of GDP per capita growth rate of the previous five years. We add this control variable because countries that are growing faster have a lower probability of an actual downturn. The change in growth rates required for a recession are larger, for example, and the shocks that are required to put an economy into recession are thus larger. Not surprisingly, we find a significant positive sign for this control variable.

3.5 Discussion and conclusions

The basic message of the chapter can be summarized as follows. In theory, an individual firm's optimal capital structure choice and the resultant macro financial structure of a country are endogenously shaped by the country's underlying parameters, such as bankruptcy costs, state verification costs, the riskless interest rate, and a productivity parameter. The financial structure differences across countries therefore basically reflect the cross-country differences of these parameters. Due to the "bankruptcy-induced downturn-amplification mechanism" associated with debt financing, a bank-based financial structure tends to exacerbate the volatility of GDP growth, and the chances and the severity of an economic downturn. Empirically, we find strong evidence consistent with these theoretical predictions: (1) Equity market size can be good at reducing GDP growth rate volatility; Credit market size doesn't significantly matter for growth rate volatility linearly, and only matters non-linearly: a larger credit market size can reduce growth-rate volatility, but only up to a certain level of credit market size; (2) Credit market size increases the probability and severity of an economic downturn (vice versa for equity market size); the non-linearity effects of credit disappear when explaining economic downturns; (3) A bank-based financial structure tends to have a more volatile growth rate and a higher probability and a more severe economic downturn.

Compared with the existing theoretical literature on the relationship between finance and economic fluctuations, our simple model offers another

particular mechanism to evaluate how finance can affect fluctuations. Admittedly, the consistency of empirical findings with the predictions of this model can only partially validate the model, since our empirical specifications and data limitations constrain us from discriminating the "bankruptcy-induced downturn-amplification mechanism" from other finance-fluctuation mechanisms as listed in the introduction of the chapter. This shortcoming is especially true for regressions using growth rate variance as a dependent variable. Nevertheless, the regressions using *Downturn* as a dependent variable resemble more a closer and direct test of the theoretical model. The relevance of the mechanism specified in the model is therefore supported empirically.

Previous empirical studies accumulatively establish the mitigating effects of credit market development on macroeconomic volatility. Nevertheless, most of them do not include equity market development indicators into regressions. In this study, we find that when stock market capitalization is included into the regressions for growth-rate volatility, the credit indicators become insignificant; it is thus actually equity market development that plays a role in reducing volatility. High correlations between these two indicators may explain the difference in results between our study and the previous ones. Our study shows, specifically, that it is equity market development that matters more dominantly. Even more strikingly, in regressions using *Downturn* as the dependent variable, we find that credit market size actually increases the probability and severity of economic downturns, which contrasts significantly with previous views. In *Downturn* regressions, a larger equity market continues to play the role of reducing the chances and severity of economic downturns.

Policy measures that stimulate the absolute and relative sizes of equity market development may be consequently prescribed in order to achieve smaller volatility and fewer and less severe economic downturns. Levine (2002) concludes that financial structure does not help explain long-term economic growth. He therefore takes a neutral position regarding which financial structure to promote. Others (Allen and Gale, 1999; and Christensen and Drejre, 1998) argue that which financial structure better facilitates growth depends on the sources and types of growth. For developing countries, for example, a bank-based financial structure is preferred. Our study shows that financial structure is not neutral, as far as reducing macro volatility and preventing economic downturns are concerned. Furthermore, our argument that market-based financial structure is preferred in order to maintain stability may put policy makers in developing countries in a difficult position if they happen to believe that a bank-based structure is better for growth.

To classify financial structures as either "bank-based" or "market-based" is not that straightforward, sometimes confusing, or even misleading, since a

bank- or market-based financial structure can have different meanings. One meaning is relationship-based versus arm-length financing, which characterizes the anonymous, blind, and competitive nature of market-based financial system vs. a bank-based financial system. An economy with a competitive (although large) banking system, however, is closer to an arm-length than a relationship-based financial system (Rajan and Zingales, 2003); to thus classify this economy as a bank-based system is too superficial. The second meaning is a universal bank versus banks with separate financial services. Nowadays, the restrictive regulation separating lending activity from investment is becoming looser in many countries. Thus an economy with a typical universal banking system can have sizeable equities dealt by banks. Throughout the chapter, we use the common terminology of bank- vs. market-based financial system, but we distinguish one financial system with another particularly by the relative size of debt vs. equity contracts. With this meaning, it is possible, then, that the distinction between bank-based and market-based financial systems does not coincide with the distinction between debt-based vs. equity-based financial systems. More exactly, within the context of this chapter the difference between bank- and market-based financial systems is defined on the basis of the characteristics setting debt contracts apart from equity contract: the extent of the necessity of verifying states and the closeness of each contract's association with bankruptcy cost. When we say, for example, that one country has a bank-based financial system, we mean that the debt contract is relatively more prevalent than the equity contract in size, and that the characteristics associated with this financial structure are lower state verification costs yet possibly more bankruptcy costs. Both our theoretical and empirical results concerning the financial structure's role in volatility are particularly defined along this line. And we believe that this conceptual dimension of the financial structure matters especially for macroeconomic volatility.

Appendix to Chapter 3

3A Proofs

Solution to the optimal capital structure problem
The problem:

$$Minimize\ \alpha_d\gamma + \alpha_e(1-\gamma) + \beta\frac{\gamma^2(1+r)^2}{2\eta^2}$$

$$subject\ to\ (i).\ 0 \leq \gamma \leq 1$$

$$(ii).\ r - r_0 = \frac{\gamma^2(1+r)^3}{6\eta^2} + \alpha_d + \beta\frac{\gamma(1+r)^2}{2\eta^2}$$

Lagrangian equation:

$$\begin{aligned} L(\gamma, r, m) &= \alpha_d\gamma + \alpha_e(1-\gamma) + \beta\frac{\gamma^2(1+r)^2}{2\eta^2} + m[r - r_0 - \frac{\gamma^2(1+r)^3}{6\eta^2} \\ &\quad -\alpha_d - \beta\frac{\gamma(1+r)^2}{2\eta^2}] - k_1\gamma - k_2(1-\gamma) \end{aligned}$$

$$k_1\gamma = 0,\ k_1 \geq 0,\ \gamma \geq 0$$

$$k_2(1-\gamma) = 0,\ k_2 \geq 0,\ 1-\gamma \geq 0$$

First order conditions:

$$-(\alpha_e - \alpha_d) + \frac{\beta(1+r)^2\gamma}{\eta^2} - m\beta\frac{(1+r)^2}{2\eta^2} - m\gamma\frac{(1+r)^3}{3\eta^2} - k_1 + k_2 = 0$$

$$\beta\frac{\gamma^2(1+r)}{\eta^2} + m - m\beta\frac{\gamma(1+r)}{\eta^2} - m\gamma^2\frac{(1+r)^2}{2\eta^2} = 0$$

$$r - r_0 = \frac{\gamma^2(1+r)^3}{6\eta^2} + \alpha_d + \beta\frac{\gamma(1+r)^2}{2\eta^2}$$

If $k_1 > 0$, then we need $\gamma = 0$; therefore, $k_2 = 0$. Then, from the simplified F.O.C.s, we get $k_1 = (\alpha_d - \alpha_e) - m\beta\frac{(1+r)^2}{2\eta^2} < 0$. Contradiction. So $k_1 = 0$.

When $k_1 = 0$, if $k_2 > 0$, then $\gamma = 1$. From the simplified F.O.C.s, we can solve for (k_2, m, r) without contradictions. Therefore, we could get a corner solution $\gamma^* = 1$.

When $k_1 = 0$ and $k_2 = 0$, we arrive at the problem for solving interior solutions.

Plugging in $k_1 = 0$ and $k_2 = 0$ to F.O.C.s, we solve this equation system for γ and r. We get,

$$\gamma_{1,2} = \frac{2[\pm((\alpha_e - \alpha_d)^2\eta^2 - \beta^2(1 + r_0 + \alpha_d)^2)\sqrt{2(\alpha_e - \alpha_d)^2\eta^2 + \beta^2(1 + r_0 + \alpha_d)^2} + \beta^3(1 + r_0 + \alpha_d)^3]}{3(\alpha_e - \alpha_d)^3\eta^2(1 + r_0 + \alpha_d)^2} \tag{3.19}$$

$$r_{1,2} = \frac{-3\beta^2(1 - r_0 - \alpha_d)(1 + r_0 + \alpha_d)^2 - 2(\alpha_e - \alpha_d)^2\eta^2(1 + 3r_0 + 3\alpha_d) \pm 3\beta(1 + r_0 + \alpha_d)^2\sqrt{2(\alpha_e - \alpha_d)^2\eta^2 + \beta^2(1 + r_0 + \alpha_d)^2}}{6\beta^2(1 + r_0 + \alpha_d)^2 - 4(\alpha_e - \alpha_d)^2\eta^2} \tag{3.20}$$

Furthermore we try to calculate out $\gamma_1 * r_1$ and $\gamma_2 * r_2$:

$$\gamma_1 * r_1 = \frac{2(\alpha_e - \alpha_d)\eta^4[6\beta^2 r_0(1 + r_0 + \alpha_d)^2 + (\alpha_e - \alpha_d)^2\eta^2(1 + 3r_0 + 3\alpha_d)^2]}{3\eta^2(1 + r_0 + \alpha_d)}$$

Since $\alpha_e > \alpha_d$, this expression is positive. However,

$$\gamma_2 * r_2 = -\frac{3\beta(\alpha_e - \alpha_d)^2\eta^2(1 + r_0 + \alpha_d)^2 + 2\beta^3(1 + r_0 + \alpha_d)^3 + [(\alpha_e - \alpha_d)^2\eta^2(1 + 3r_0 + 3\alpha_d) + 2\beta^2(1 + r_0 + \alpha_d)^2]\sqrt{2(\alpha_e - \alpha_d)^2\eta^2 + \beta^2(1 + r_0 + \alpha_d)^2}}{3(\alpha_e - \alpha_d)^3\eta^2(1 + r_0 + \alpha_d)}$$

which is negative when $\alpha_e > \alpha_d$, proving that γ_2 and r_2 in fact have opposite signs, which is not possible in theory. Therefore, the only reasonable optimal capital structure choice is $(\gamma^*, r^*) = (\gamma_1, r_1)$, both taking the plus signs of (3.19) and (3.20).

From the first-order conditions, we can get two border solutions:

1. $\gamma^* = 0$ if $\alpha_e = \alpha_d$. If there is no difference between equity and debt financing costs associated with state verification, there is no need to borrow, since the firm is fully equity financed.

2. $\gamma^* = 1$ if

$$\begin{aligned} 12\beta^3(1+r_0+\alpha_d)^4 &= (\alpha_e-\alpha_d)\eta^2[12\beta^2(1+r_0+\alpha_d)^2 - 8(\alpha_e-\alpha_d)^2\eta^2 \\ &\quad +9(1+r_0+\alpha_d)^2(\alpha_e-\alpha_d)^2] \end{aligned}$$

One particular example for $\gamma^* = 1$ is the following. When $8\eta^2 = 9(1+r_0+\alpha_d)^2$, $\beta = 0$ is a sufficient condition for full debt financing to be optimal. Put differently, under a certain relationship between the productivity parameter and the riskless interest rate, if the bankruptcy cost is negligible, there is no need to issue equity, since the firm is fully debt financed.

Proposition 3.1

Proof. It can be easily proved that $\frac{\partial\gamma^*}{\partial\beta} < 0$; $\frac{\partial\gamma^*}{\partial(\alpha_e-\alpha_d)} > 0$; $\frac{\partial\gamma^*}{\partial\eta} > 0$; $\frac{\partial\gamma^*}{\partial r_0} < 0$. For example,

$$\frac{\partial\gamma^*}{\partial\beta} = \frac{\begin{array}{c}2\beta(1+r_0+\alpha_d)[(\alpha_e-\alpha_d)^2\eta^2+\beta^2(1+r_0+\alpha_d)^2 \\ -\beta(1+r_0+\alpha_d)\sqrt{2(\alpha_e-\alpha_d)^2\eta^2+\beta^2(1+r_0+\alpha_d)^2}]\end{array}}{-(\alpha_e-\alpha_d)^3\eta^2\sqrt{2(\alpha_e-\alpha_d)^2\eta^2+\beta^2(1+r_0+\alpha_d)^2}}$$

Since the expression in the bracket of the nominator is positive, and the denominator is negative, $\frac{\partial\gamma^*}{\partial\beta} < 0$. ■

Proposition 3.2

Proof. It can be proved by taking derivatives of expression (3.13) w.r.t. corresponding variables. For example,

$$\frac{\partial\gamma^*(1+r^*)/\eta}{\partial\eta} = \frac{\beta(1+r_0+\alpha_d)[\beta(1+r_0+\alpha_d) - \sqrt{2(\alpha_e-\alpha_d)^2\eta^2+\beta^2(1+r_0+\alpha_d)^2}]}{-(\alpha_e-\alpha_d)\eta^2\sqrt{2(\alpha_e-\alpha_d)^2\eta^2+\beta^2(1+r_0+\alpha_d)^2}}$$

Since the expression in the bracket of the nominator is negative, and the denominator is negative, $\frac{\partial\gamma^*(1+r^*)/\eta}{\partial\eta} > 0$. ■

3B Figures

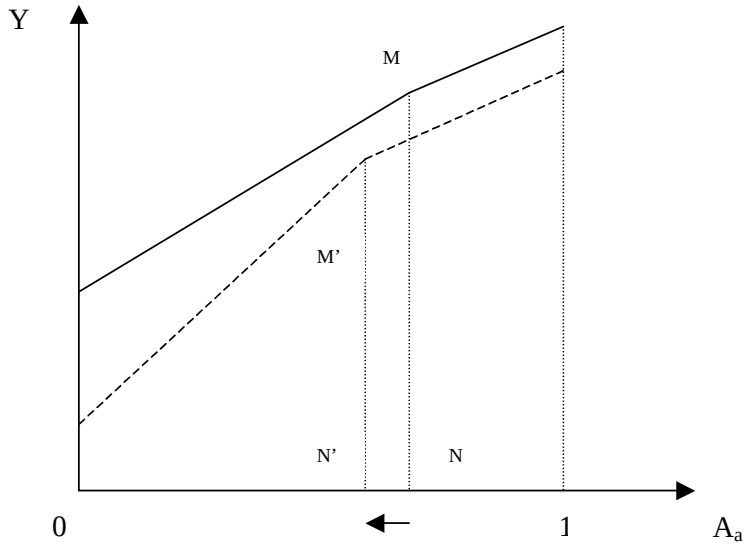

Figure 3.1: The effects of increasing β on output volatility

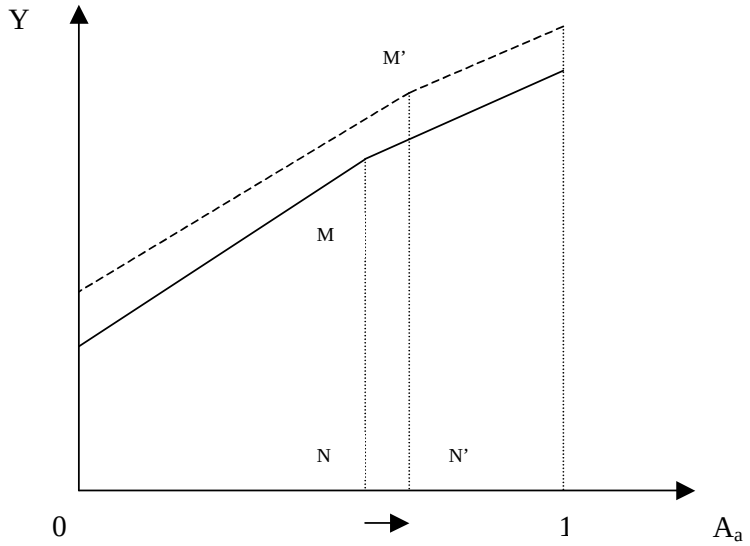

Figure 3.2: The effects of increasing $\alpha_e - \alpha_d$ on output volatility

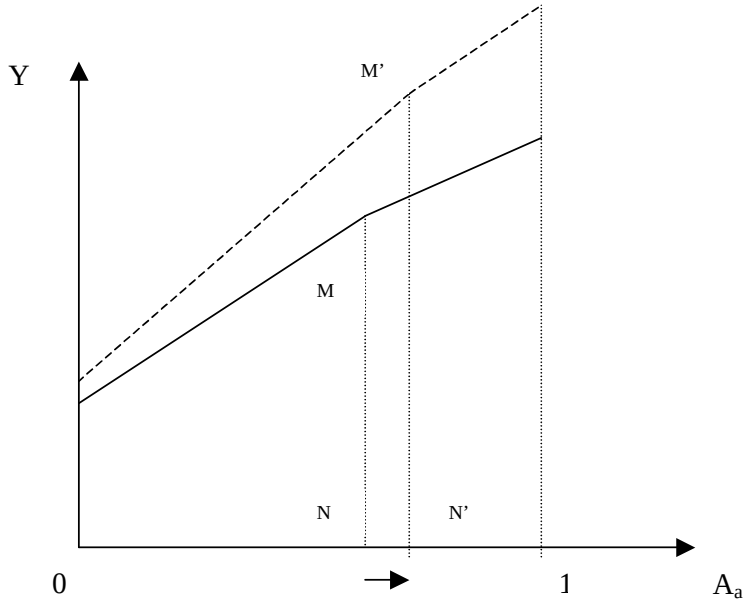

Figure 3.3: The effects of increasing η on output volatility

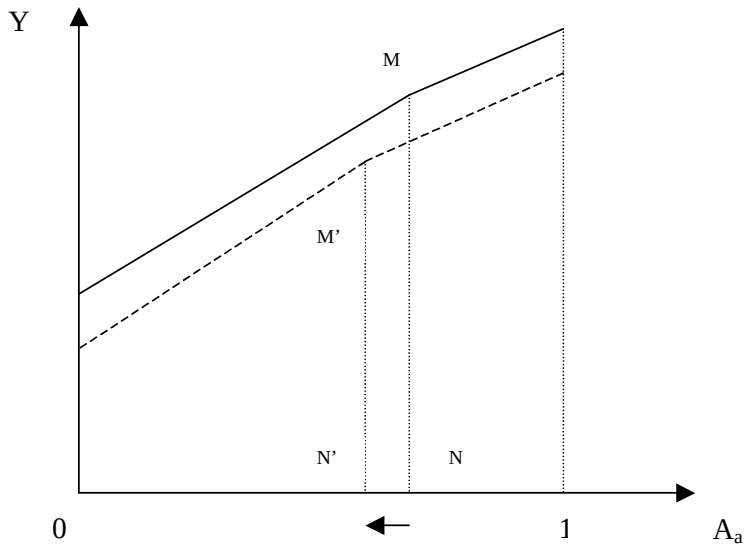

Figure 3.4: The effects of increasing r_0 on output volatility

3C Variable definitions

- Dependent variables (Source: World Development Indicators dataset, 2003)

sd_ GDPg: standard deviations of GDP per capita growth rate over certain periods (1960-2002).

Downturn: constructed annual data, equal to zero if GDP per capita growth rate is non-negative; equal to GDP per capita growth rate if GDP per capita growth rate is negative (1960-2002).

- Financial system development and structure indicators (Source: Beck, Thorsten, Asli Demirguc-Kunt and Ross Levine (2000))

CredPriv: Claims on private sector by deposit money banks as a share of GDP (1960-1997).

Mcap: Stock market capitalization as a share of GDP (1960-1997).

PriBonCap: Private bond market capitalization to GDP; only available for limited countries between 1990 to 1997.

LongPriDe: Long-term Private Debt Issues to GDP; available for limited countries between 1980 to 1997.

Capital: equity type financial instruments, constructed as the sum of *Mcap, PriBonCap,* and *LongPriDe.*

Struc: constructed financial structure measurement, defined as stock market capitalization divided by private sector claims of deposit banks *(Mcap / CredPriv)* over the same period (1960-1997).

- Instrumental Variables (Source: La Porta et al. (1996)).

Srights: Anti-director rights. An index aggregating shareholder rights. The index ranges from 0 to 5; the higher the number, the more minority shareholders are protected. The index is formed by adding 1 if: (1) the country allows shareholders to mail their proxy vote; (2) shareholders are not required to deposit their shares prior to the General Shareholders' Meeting; (3) cumulative voting is allowed; (4) an oppressed minorities mechanism is in place; (5) the minimum percentage of share capital that entitles a shareholder to call for an Extraordinary Shareholders' Meeting is less than or equal to 10% (the sample median).

Crights: Creditor rights. An index aggregating creditor rights. The index ranges from 0 to 4; a higher number means more protection to creditors. The index is formed by adding 1 if: (1) the country imposes restrictions, such as creditors' consent or minimum dividends, to file for reorganization;

(2) secured creditors are able to gain possession of their security once the reorganization petition has been approved (no automatic stay); (3) the debtor does not retain the administration of his property pending the resolution of the reorganization; (4) secured creditors are ranked first in the distribution of the proceeds that result from the disposition of the assets of a bankrupt firm.

Law: Rules of law. Assessment of the law and order tradition in the country produced by the country risk rating agency International Country Risk (ICR). Average of the months of April and October of the monthly index between 1982 and 1995. Scale from 0 to 10, with lower scores for less tradition of law and order (La Porta (1996) changed the scale from its original range going from 0 to 6).

Account: Accounting standard. Index created by examining and rating companies' 1990 annual reports on their inclusion or omission of 90 items. These items fall into seven categories (general information, income statements, balance sheets, funds flow statements, accounting standards, stock data, and special items). A minimum of three companies in each country were studied. Non-financial companies represented 70 percent, and financial companies represented the remaining 30 percent. A higher number corresponds to a higher accounting standard.

- Controlling variables (Source: World Development Indicators dataset, 2003)

GovConsump: General government final consumption expenditure (as % of GDP). It includes all government current expenditures for purchases of goods and services (including compensation of employees)(1960-2002).

Inflation: annual growth rate of the GDP deflator. GDP deflator is the ratio of GDP in current local currency to GDP in constant local currency. It shows the rate of price change in the economy as a whole (1960-2002).

Trade: The sum of exports and imports of goods and services as % of GDP (1960-2002).

(sd_)PrivCapFlow: (Standard deviation) of net capital flows as % of GDP. Net private capital flows consist of private debt (commercial bank lending, bonds, and other private credits) and non-debt flows (FDI and portfolio equity investment) (1960-2002).

e_change: absolute value of real effective exchange rate change in percentage. The real effective exchange rate is the nominal effective exchange rate (a measure of the value of a currency against a weighted average of several foreign currencies) divided by a price deflator or index of costs (1960-2002).

OECD: dummy variable, equal to one if a country is a member of the OECD.

3D Tables

Table 3.2: Summary statistics

Variables	# Obs.	Mean	Std. Dev.	Min.	Max.
Country				1	175
Year				1960	2002
GDPg_pc	6015	1.83	6.70	-52.10	138.90
Downturn	6015	-1.33	3.648	-52.10	0
CredPriv	5333	34.69	31.16	0.66	203.16
MCap	1653	37.07	51.25	0	531.26
PriBonCap	281	20.89	22.99	0	110.78
LongPriDe	498	2.54	3.60	0	18.40
Capital	128	79.68	61.28	6.54	317.46
Stuc	1569	.61	.64	0.00	6.58
GovConsump	5591	15.98	7.08	2.58	76.22
Inflation	6034	17.37	58.21	-55.82	975.93
Trade	5713	71.63	43.03	1.53	296.02
PriCapFlow	3304	3.07	6.32	-82.87	145.21
e_change	2021	11.19	40.19	0.00	785.06
OECD	9065	0.14	0.35	0	1
Srights	49	3.00	1.31	0	5
Crights	47	2.30	1.37	0	4
Law	91	3.45	1.58	0.86	6
Account	41	60.93	13.40	24	83

Notes: *PriBonCap, LongPriDe, Capital,* and *Stuc*Only are available for limited countries between 1990-1997. *Srights, Crights, Law, and Account* are used as instrumental variables, all of which have one observation for each country.

Table 3.3: Finance and GDP growth rate volatility: cross-section results

A1. Financial development as explanatory variables: no Credit squared term included

	(1)	(2)	(3)	(4)
CredPriv	-0.003(0.017)	0.007(0.024)	0.030(0.025)	0.040*(0.027)
Mcap	-0.014*(0.011)	-0.034**(0.015)	-0.031**(0.015)	-0.028**(0.014)
GovConsump	0.080*(0.060)	0.220**(0.095)	0.183**(0.108)	-0.029(0.129)
Trade	0.014***(0.006)	-0.016(0.014)	-0.008(0.015)	0.024(0.020)
OECD	-2.210***(0.600)	-1.675**(0.778)	-1.501**(0.695)	-1.207*(0.780)
sd_PrivCapFlow		0.808***(0.248)	0.559**(0.272)	0.066(0.276)
Inflation			0.024***(0.008)	0.035***(0.011)
e_change				0.019*(0.013)
Const.	3.578***(0.852)	1.198(1.126)	0.546(1.046)	1.834(1.426)
# Obs.	108	72	72	37

A2. Financial development as explanatory variables: Credit square term included

	(1)	(2)	(3)	(4)
CredPriv	-0.044(0.039)	-0.135***(0.049)	-0.081**(0.044)	-0.064(0.073)
CredPriv(square)	0.0003*(0.0002)	.0019***(0.001)	.0014***(.0006)	.0012*(.0008)
Mcap	-0.015*(0.011)	-0.040***(0.013)	-0.036**(0.015)	-0.036***(0.011)
GovConsump	0.109**(0.064)	0.222**(0.098)	0.191**(0.110)	-0.003(0.123)
Trade	0.013**(0.006)	-0.013(0.013)	-0.008(0.014)	0.023(0.019)
OECD	-2.000***(0.681)	-1.377**(0.758)	-1.312**(0.702)	-1.258*(0.788)
sd_PrivCapFlow		0.780***(0.223)	0.588**(0.259)	0.209(0.288)
Inflation			0.020***(0.008)	0.028***(0.009)
e_change				0.015(0.017)
Const.	4.037***(0.943)	2.986**(1.337)	2.015**(1.151)	3.015*(2.020)
# Obs.	108	72	72	37

A3. Replacing equity indicator (*Mcap*) with broader equity indicator (*Capital*)

	(1)	(2)
CredPriv	0.005(0.009)	0.016(0.038)
CredPriv(square)		-0.000(0.000)
Capital	-0.008*(0.005)	-0.008**(0.005)
GovConsump	0.129***(0.034)	0.146***(0.054)
Trade	0.002(0.004)	0.002(0.004)
OECD	-1.421**(0.712)	-1.428***(0.707)
Const.	6.356***(0.813)	6.266***(0.870)
# Obs.	26	26

B. Financial structure as explanatory variable

	(1)	(2)	(3)	(4)
Struc	-0.505(0.400)	-1.023**(0.445)	-0.816**(0.456)	-1.309*(0.928)
GovConsump	0.101*(0.065)	0.238**(0.101)	0.199**(0.113)	0.008(0.121)
Trade	0.009**(0.005)	-0.017(0.015)	-0.011(0.017)	0.020(0.021)
OECD	-2.692***(0.453)	-1.690**(0.725)	-1.306**(0.600)	-0.928*(0.640)
sd_PrivCapFlow		0.781***(0.275)	0.603**(0.329)	0.171(0.290)
Inflation			0.022**(0.008)	0.032***(0.010)
e_change				0.025**(0.013)
Const.	3.592***(0.788)	1.385*(0.855)	1.229*(0.850)	2.565**(1.393)
# Obs.	108	72	72	37

Notes: *(**, ***): statistical significance at the 10% (5%, 1%) confidence levels; number in parentheses is standard error; dependent variable is *sd_GDPg*.

Table 3.4: Finance structure and GDP growth rate volatility: cross-section results with instrumental variables

A. Legal determinants of financial structure

	(1)	(2)	(3)	(4)
Srights	0.126***(0.046)	0.145***(0.046)	0.116***(0.047)	0.113**(0.051)
Account	0.012***(0.004)		0.016***(0.005)	0.015***(0.005)
Law		0.023(0.033)	-0.049(0.038)	-0.048(0.039)
Crights				0.031(0.039)
Const.	-0.380*(0.228)	0.218(0.180)	-0.337*(0.223)	-0.387*(0.245)
# Obs.	40	48	40	39

B. Results comparison between with and without IV variables

	with IV	without IV
Struc	-0.362*(0.272)	0.048(0.321)
GovConsump	-0.081***(0.028)	-0.081***(0.029)
Trade	-0.000(0.003)	-0.002(0.003)
OECD	-1.231***(0.383)	-1.199***(0.397)
Const.	5.458***(0.601)	5.219***(0.656)
# Obs.	39	39

Notes: *(**, ***): statistical significance at the 10% (5%, 1%) confidence levels; number in parentheses is standard error; dependent variable of A is *Struc* and dependent variable of B is *sd_ GDPg;* IV variables used in B are *Srights* and *Account*.

Table 3.5: Finance and GDP growth-rate volatility: panel results for two time periods

A1. Financial development as explanatory variables: no Credit squared term included

	(1)	(2)	(3)	(4)
CredPriv	-0.011(0.010)	-0.022(0.018)	0.005(0.017)	-0.011(.019)
Mcap	-0.011*(0.008)	-0.014(0.012)	-0.020**(0.012)	-0.006(.012)
GovConsump	0.023(0.035)	0.078*(0.055)	0.044(0.051)	0.012(.099)
Trade	0.017***(0.005)	0.003(0.011)	0.012(0.011)	0.026**(.015)
OECD	-1.534***(0.416)	-0.848**(0.481)	-0.652**(0.370)	-0.554(.649)
sd_PrivCapFlow		0.725***(0.222)	0.444**(0.214)	0.056(.252)
Inflation			0.028***(0.006)	0.029***(.010)
e_change				0.008(.013)
Const.	3.797***(0.597)	2.258(0.815)	1.331*(0.816)	2.068*(1.565)
# Obs.	149	90	90	45

A2. Financial development as explanatory variables: Credit square term included

	(1)	(2)	(3)	(4)
CredPriv	-0.043**(.024)	-0.094***(0.039)	-0.081**(0.044)	-0.064(0.073)
CredPriv(square)	.0002**(.0001)	.0008**(.0003)	.0014***(.0006)	.0012*(.0008)
Mcap	-0.013*(.008)	-0.026**(0.013)	-0.036**(0.015)	-0.036***(.011)
GovConsump	0.042(.036)	0.104**(0.057)	0.191**(0.110)	-0.003(0.123)
Trade	0.017***(.005)	0.002(0.010)	-0.008(0.014)	0.023(0.019)
OECD	-1.363***(.468)	-0.643*(0.451)	-1.312**(0.702)	-1.258*(0.788)
sd_PrivCapFlow		0.691***(0.217)	0.588**(0.259)	0.209(0.288)
Inflation			0.020***(0.008)	0.028***(.009)
e_change				0.015(0.017)
Const.	4.169***(.666)	3.240***(1.027)	2.015**(1.151)	3.015*(2.020)
# Obs.	149	90	90	45

B. Financial structure as explanatory variable

	(1)	(2)	(3)	(4)
Struc	-0.529*(0.375)	-0.513*(0.364)	-0.698**(0.339)	-1.165*(0.778)
GovConsump	0.030(0.036)	0.088*(0.058)	0.048(0.051)	-0.001(0.098)
Trade	0.012***(0.005)	0.001(0.012)	0.012(0.013)	0.029**(0.015)
OECD	-2.160***(0.343)	-0.921**(0.510)	-0.616**(0.346)	-0.452(0.606)
sd_PrivCapFlow		0.659***(0.232)	0.407*(0.252)	-0.024(0.243)
Inflation			0.030***(0.006)	0.036***(.010)
e_change				0.021**(0.010)
Const.	3.761***(0.588)	1.884***(0.666)	1.499***(0.614)	1.970*(1.387)
# Obs.	149	90	90	45

Notes: *(**, ***): statistical significance at the 10% (5%, 1%) confidence levels; number in parentheses is standard error; dependent variable is *sd_GDPg.*

Table 3.6: Finance and GDP growth rate volatility: panel results for three time periods

A1. Financial development as explanatory variables: no Credit squared term included

	(1)	(2)	(3)	(4)
CredPriv	-0.012(0.010)	-0.022*(0.017)	0.008(0.014)	-0.002(0.014)
Mcap	-0.009*(0.007)	-0.015*(0.010)	-0.020**(0.010)	-0.015*(0.009)
GovConsump	0.026(0.037)	0.099**(0.053)	0.061(0.048)	0.068(0.077)
Trade	0.017***(0.005)	0.002(0.011)	0.010(0.012)	0.022**(0.011)
OECD	-1.342***(0.406)	-0.478(0.555)	-0.305(0.360)	-0.273(0.559)
sd_PrivCapFlow		0.828***(0.208)	0.506**(0.222)	0.254(0.224)
Inflation			0.033***(0.006)	0.034***(0.008)
e_change				0.047***(0.013)
Const.	3.573***(0.614)	1.578**(0.778)	0.654(0.714)	-0.220*(1.034)
# Obs.	190	107	107	49

A2. Financial development as explanatory variables: Credit square term included

	(1)	(2)	(3)	(4)
CredPriv	-0.048**(0.023)	-0.084***(0.034)	-0.022(0.030)	-0.002(0.040)
CredPriv(square)	.0002**(.0001)	.0007***(.0003)	.0003*(.0002)	.0000(.0003)
Mcap	-0.011*(0.007)	-0.026**(0.011)	-0.024**(0.011)	-0.015*(0.011)
GovConsump	0.047(0.039)	0.125***(0.052)	0.075*(0.046)	-0.067(0.074)
Trade	0.017***(0.005)	0.000(0.010)	-0.008(0.011)	0.022**(0.010)
OECD	-1.156***(0.453)	-0.327(0.520)	-0.249(0.355)	-0.273(0.560)
sd_PrivCapFlow		0.812***(0.208)	0.519***(0.222)	0.254(0.243)
Inflation			0.031***(0.006)	0.034***(0.007)
e_change				0.047***(0.014)
Const.	4.005***(0.684)	2.523***(0.993)	1.132(0.952)	0.221(1.734)
# Obs.	190	107	107	49

B. Financial structure as explanatory variable.

	(1)	(2)	(3)	(4)
Struc	-0.547*(0.378)	-0.588*(0.430)	-0.682**(0.387)	-1.413**(0.803)
GovConsump	0.032(0.037)	0.113**(0.056)	0.066*(0.048)	0.059(0.078)
Trade	0.012***(0.005)	-0.00(0.013)	0.009(0.013)	0.025**(0.012)
OECD	-2.000***(0.352)	-0.465(0.588)	-0.254(0.339)	-0.169(0.536)
sd_PrivCapFlow		0.743***(0.227)	0.476**(0.253)	0.153(0.212)
Inflation			0.035***(0.006)	0.038***(0.008)
e_change				0.048***(0.013)
Const.	3.509***(0.604)	1.196**(0.642)	0.909**(0.550)	0.286*(0.921)
# Obs.	190	107	107	49

Notes: *(**, ***): statistical significance at the 10% (5%, 1%) confidence levels; number in parentheses is standard error; dependent variable is *sd_GDPg.*

Table 3.7: Finance and economic downturn: censored panel data regression

A1. Financial development as explanatory variable: no credit squared term included

	(1)	(2)	(3)	(4)
CredPriv	-0.016**(0.008)	-0.060***(0.017)	-0.065***(0.017)	-0.066***(0.022)
Mcap	0.016**(0.008)	0.069***(0.021)	0.067***(0.021)	0.072***(0.027)
mv5_GDPg	0.891***(0.085)	0.853***(0.105)	0.792***(0.104)	0.802***(0.146)
GovConsump	-0.047*(0.035)	-0.170***(0.067)	-0.196***(0.067)	-0.159*(0.119)
Trade	0.003(0.006)	0.009(0.011)	0.010(0.011)	0.010(0.020)
OECD	1.852***(0.474)	-0.878(0.979)	-0.757(0.967)	3.785*(2.025)
PrivCapFlow		-0.155*(0.102)	-0.148*(0.101)	-0.096(0.139)
Inflation			-0.012***(0.004)	-0.009**(0.005)
e_change				-0.021*(0.013)
Const.	2.491***(0.666)	5.704***(1.103)	6.513***(1.151)	5.321***(1.965)
χ^2 test	141.64***	87.51***	94.10***	56.06***
Log-likelihood	-975.50	-554.46	-550.60	272.40
# Countries	88	56	56	30
# Obs.	1064	520	520	224
#uncensored	239	137	137	73

A2. Financial development as explanatory variable: credit squared term included

	(1)	(2)	(3)	(4)
CredPriv	-0.028*(0.019)	-0.040(0.035)	-0.055*(0.035)	-0.085*(0.067)
CredPriv_squa	0.000(0.000)	-0.000(0.000)	-0.000(0.000)	0.000(0.001)
Mcap	0.016**(0.008)	0.071***(0.021)	0.068***(0.021)	0.067**(0.032)
mv5_GDPg	0.896***(0.085)	0.854***(0.105)	0.793***(0.104)	0.799***(0.147)
GovConsump	-0.039(0.037)	-0.177***(0.068)	-0.199***(0.068)	-0.158*(0.119)
Trade	0.002(0.006)	0.009(0.011)	0.010(0.011)	0.009(0.020)
OECD	1.874***(0.474)	-0.848(0.980)	-0.743(0.968)	3.808**(2.026)
PrivCapFlow		-0.156*(0.102)	-0.149*(0.101)	-0.098(0.139)
Inflation			-0.012***(0.004)	-0.009**(0.005)
e_change				-0.021*(0.013)
Const.	2.632***(0.704)	5.392***(1.191)	6.347***(1.253)	5.683***(2.332)
χ^2 test	142.94***	87.64***	94.06***	56.21***
Log-likelihood	-975.36	-554.25	-550.55	-272.36
# Countries	88	56	56	30
# Obs.	1064	520	520	224
#uncensored	239	137	137	73

B. Financial structure as explanatory variable.

	(1)	(2)	(3)	(4)
Struc	1.422***(0.474)	3.222***(0.894)	3.072***(0.882)	3.543***(1.323)
mv5_GDPg	0.869***(0.084)	0.815***(0.104)	0.762***(0.105)	0.763***(0.147)
GovConsump	-0.060**(0.035)	-0.177***(0.067)	-0.200***(0.067)	-0.183*(0.118)
Trade	0.001(0.006)	0.004(0.011)	0.005(0.011)	0.006(0.019)
OECD	1.573***(0.429)	-0.569(0.978)	-0.424(0.970)	4.267***(2.050)
PrivCapFlow		-0.213**(0.100)	-0.212**(0.099)	-0.172(0.140)
Inflation			-0.010**(0.004)	-0.006(0.005)
e_change				-0.018*(0.013)
Const.	1.824***(0.647)	3.945***(1.016)	4.556***(1.058)	3.304***(1.941)
χ^2 test	145.00***	84.34***	88.98***	52.12***
Log-likelihood	-973.55	-555.27	-552.81	274.27
# Countries	88	56	56	30
# Obs.	1064	520	520	224
#uncensored	239	137	137	73

Notes: *(**, ***): statistical significance at the 10% (5%, 1%) confidence level; number in parentheses is standard error; dependent variable is *Downturn.*

Chapter 4

Inequality, Credit Market Imperfections and Segmentation, and Economic Growth

4.1 Introduction

The main arguments underlying the presupposition that inequality is good for economic growth are investment indivisibility and incentives considerations. The traditional wisdom of a trade-off between equality and efficiency follows similar arguments. In the past 15 years, however, accumulated studies have explored whether and how inequality could be bad for economic growth. Among this burgeoning body of literature, Persson and Tabellini (1994) use a median voter approach to show how income inequality leads to redistribution pressure, and which distortions, in turn, discourage investment and reduce economic growth. Benabou (1996), applying a social conflict approach, states that inequality-induced social conflict reduces the security of property rights and increases the predatory activities of the poor, thereby discouraging accumulation and retarding economic growth. Approaching the issue from demand side, Murphy, Shleifer and Vishny (1989) argue that extreme concentration of wealth in the hands of the very rich will manifest itself in the demand for handmade and imported luxuries rather than for domestic manufactures, thereby slowing down the industrialization process and economic growth. The conventional wisdom has been challenged also by a number of recent empirical studies. Alesina and Rodrik (1994), Persson and Tabellini (1994), and Perotti (1996) have all found a negative correla-

tion between average growth and measures of inequality over the 1960-1986 period.

This chapter constructs a special theoretical model to examine how inequality could be bad for economic growth when the credit market is imperfect. It is no new idea that wealth distribution could affect the level of output and economic growth when the credit market is imperfect. This line of research, which dates back to Loury (1981), has been recently explored by Greenwood and Jovanovic (1990), Banerjee and Newman (1993), Galor and Zeira (1993), Aghion and Bolton (1997), Piketty (1997), and Ahgion et.al. (1998). The essential point is that financial market imperfections (such as informational asymmetries, transaction costs, and contract enforcement costs) might be especially binding on individuals with low wealth who lack collateral, credit histories, and connections, thereby preventing them from accessing profitable investment opportunities (in either human or physical capital). The efficiency loss generated by this market imperfection will thus rise with the number of individuals whose financial constraint is binding. Higher inequality typically implies a larger share of the population below the threshold level of wealth, and hence larger efficiency losses. However, the current literature presents the following features. First, some of these papers have followed a partial equilibrium approach by focusing on the demand side of financial markets. An economy comprises a fixed number of firms, each of which needs funds to finance a project of fixed size. Firms are distinguished by their level of net worth, which determines the capacity (if any) and source of finance. Thus total credit in the models is completely determined on the demand side of the market. Second, the existing papers often consider only one source of finance when both demand and supply sides are analyzed and interest rates are determined at equilibrium. Thus, a rich structure of financing is neglected. Third, some of the authors mentioned above stress the link between the rate of growth of the economy, the distribution of wealth and occupational choices when credit markets are imperfect. But financial institutions are not modeled clearly and financial institutions do not adapt actively to the economic environment.

This chapter, in a general equilibrium framework, shows how the existence of two specific financial institutions exhibiting technological differences in overcoming moral hazard problems leads to rich connections between rich and poor people, on the one hand, and production efficiency and economic growth, on the other. In the model, an agent's decisions are endogenous – both whether to participate on the supply or the demand side of the credit market, and in which financial markets to participate. The size of the investments and the equilibrium interest rates are also endogenous. This chapter examines how an "informal" credit market could emerge endogenously; this

would release some of the financially constrained poor individuals operating within the mere "formal" credit market, thereby increasing aggregate output and economic growth.

Quite often, credit markets are inherently imperfect, with moral hazard and adverse selection problems due to information asymmetry. Developing countries (especially the rural areas of developing countries) particularly struggle with information asymmetry problems in the credit market. This can be attributed to the insufficiency of the legal or institutional infrastructures, the widely dispersed locations of rural households, the paucity of the poor in the rural economy, etc. We list the following two quotations: one describes (the severity of) credit constraints in rural credit markets; the other shows the importance of the ability of lenders to provide collateral in obtaining credit in rural areas.

> "The plot questionnaire does ask whether a given rural household would be willing to borrow more (presumably at prevailing interest rates) to finance labor, fertilizer, or herbicide; that is, would profits be increased? Here eight out of twelve farmers in Yang Pieng say yes, they are "credit constrained"; three say that they fear debt; two say that they are not brave enough to take the risk; two cite there is that no place to borrow or lack of money;..."(Townsend ,1995).
>
> "In rural credit markets, high default rates have prevented the institutions from being self-financing: recurrent and often large injections of government funds have been required. And despite these subsidies, many of these credit programs have had little success in reaching farmers without collateral or with below-average income." (Hoff and Stigltz, 1990).

One particular consequence of rural credit market imperfections is the prevalence of "informal" credit markets in rural developing countries, which include credit cooperations and associations, moneylenders, usury, pawnshops, etc. (Besley and Coate, 1995; and Banerjee, et al., 1994). In a study on Taiwanese rotating saving and credit associations in rural areas, Besley and Levenson (1996) claim that, on average, 20 percent of households participate in such an association every year. Kan (2000) shows that informal financial channels were heavily relied upon by small businesses in Taiwan during the period 1977-1992. In the case of Korea, the informal credit market was also of considerable importance (Cole and Park, 1983). Ghate (1992) reviewed the data showing that at the mid of 1980s the share of informal rural borrowing in China accounted for one-third to two-thirds of total borrowing.

It is interesting to note that most policy-makers in developing countries oppose this way of rural financing and take all kinds of measures to forbid and eradicate them. In practice, however, it is not easy to enforce these policy measures effectively. For example, in the late 1980s and early 1990s China launched multiple "financial rectification campaigns" to shut down private money houses, which, nonetheless, continued to operate underground – not only in the costal south, but also in northern central provinces such as Henan (Tsai, 2002, Chapter 5). These puzzling facts have motivated the attempts in this chapter to model the precise role of informal financial institutions in the development process, and thus to evaluate the hostile policy stance toward the informal credit markets in rural areas of developing countries.

Generally speaking, there are several features displayed by borrowers, or their credit needs, that explain reliance on the informal market. First, informal credit institutions may have informational advantages compared to formal ones (Besley, 1995). Therefore, for borrowers who possess no (or insufficient) collateral, the informal credit institutions may be in a position to lend to them without collateral, merely on the basis of first-hand information on the borrower, or on the strength of community ties. Secondly, some kinds of informal lenders, such as produce traders, input dealers and raw-material suppliers, who have transactions with the borrowers, may be in a more flexible position to devise collateral substitutes such as the interlink of credit with marketing, employment or leasing transactions. Interlinking lenders could easily cut off these other transactions with the borrowers, which provides the additional incentives (possibly strong) for borrowers to repay the credit on time. Thirdly, the loan may be a small or short-duration loan, for which the transaction costs may be so high as to place the loan beyond the profitable reach of the formal sector because of its greater reliance on the pooling of deposits and maturity transformation. Fourthly, from the demand side, whenever timeliness is crucial (as in emergencies, or whenever a business opportunity must be seized immediately), the speed with which the informal sector can make loans gives it an advantage over the formal sector. From the supply side, when there exists significant delayed disbursement of formal credit, informal credit institutions emerge (Chaudhuri and Gupta, 1994). Fifthly, the formal sector is subject to a variety of regulations relating to capital reserve and liquidity requirements, ceilings on lending and the deposit interest rate, mandatory credit targets, and audit and reporting requirements. Together with constraints imposed by the internal bureaucratic procedures of large-scale formal sector institutions, these requirements raise transaction costs in the formal sector to levels well above those in the informal sector. Credit controls may also prevent the formal sector from making loans for a variety of purposes, including consumption loans, so that the bor-

rower has no alternative but to approach the informal sector. This chapter, within the context of an economy with a heterogeneous ability to provide collateral, will particularly focus on the informal credit markets' advantages arising from their not relying on collateral, to explain the emergence of these markets and to analyze their efficiency and economic growth implications.

The theoretical part of this chapter studies a "family business" economy with overlapping generations. The economy features infinite families, each of which is both a consumption and a production unit. Two generations live in each family at the same time: the young and the old (we can interpret them as the son and father, respectively). The young works for the old. The young gets wage income and the old gets capital income. We introduce heterogeneity into this overlapping generation model by relaxing the assumption that the old have identical capital endowments. To simplify the calculation without loss of generality, we assume that the young consume only in the second period (when they are old). They thus save all of their wage income as the next period's capital. The capital inequality is therefore the result of the previous period's wage-income inequality.

The key argument is as follows. The agents differ in terms of the capital they have at the beginning of the period. They have access to the credit markets to borrow or lend in order to undertake the optimal investment level, and borrowers have limited liability. When there are information asymmetries in the credit market, the presence of limited liability of borrowers imparts a preference for risk among borrowers. This is because limited ability on the part of borrowers implies that lenders bear all the downside risk. On the other hand, all returns above the loan repayment obligation accrue to borrowers. We assume two types of financial institutions intermediating savings between borrowers and lenders: modern commercial banks and informal credit institutions. Each financial institution relies on a specific technology to ensure that moral hazard behavior doesn't happen. The cost of monitoring is infinite for modern banks; banks thus rely on collateral requirements to provide incentives for borrowers not conducting moral hazard behavior. This kind of intermediary officially exists within the framework of the law or official documents. If we call this intermediary the "formal' one, and consider it more or less exogenously given, then the second kind of intermediary is more "informal" and does not rely on collateral to solve moral hazard problems. Because of their proximity to the borrowers, the informal financial institutions could directly monitor the project undertaken at a cost related to the loan size. We call it the "informal credit market" since it is out of the reach of official supervision and the legal framework[1]. Given the

[1]However, there is no enforcement problem in an informal contract. A formal contract

"formal" credit market, the informal one emerges endogenously (i.e. if only a formal credit market exists, there must be some agents distinguished by the initial capital having incentives to promote the formation of the informal credit markets). In equilibrium, the poor are willing to rely on the informal market for borrowing; agents with medium-high wealth levels have access to the formal credit market for borrowing, but the poor segment of these medium-high wealth individuals are financially constrained; the rich agents are lenders and self-finance their projects. When interpreting the model, we think this model is more rural specific because many of the features of the model are actually abstracted from stylized facts in rural areas.

The empirical part of this chapter uses cross-province data of China instead of the cross-country data that are most often used to check the relationship between initial inequality and growth. The advantage of one-country-cross-region data analyses is that they avoid the institutional and geographical disturbances that are inherently unavoidable in cross-country data regressions. A robust negative relationship between inequality and growth is obtained. Moreover, the policy dummy variable signalling permission or proscription of the informal credit market presents a positive sign, which is to a certain extent consistent with the theoretical model's prediction.

Several papers are closely related to the current study. The Holmstrom and Tirole (1997) model features a moral hazard problem when firms choose projects in which to invest. Specifically, they could choose to work less diligently to get private benefits, but at the cost of a higher chance of project failure. Firms do not have enough of their own capital to reach the investment size requirements and have to rely on external finance – either direct or indirect finance. At equilibrium, only well-capitalized firms can finance their investments directly. Poorly capitalized firms cannot invest at all. The firms in-between finance their investments with a mixture of direct and indirect finance. Aghion and Bolton (1997) drop the assumption of production function convexity and asks for a fixed initial capital outlay in the risky "entrepreneurial" activity with high return, giving rise to the poor merely relying on the "backyard" activity with a deterministic low return, if they can not borrow or do not want to borrow. By assuming that the "entrepreneurial" activity's probability of success increases with the costly effort of the undertakers, the model predicts that the lower the borrower's initial wealth, the less effort she devotes to increasing the probability of success of her project because she has to share a larger fraction of the marginal returns

is enforced by legal institutions. We think that compliance in an informal contract is ensured by the threat of reduction or elimination of access to credit in the future because of repeated interactions.

from her effort with the lenders. Given the equilibrium rate of return the lenders requires, the poorest individuals get credit rationed or constrained – since their efforts are distorted such that they could not pay the lenders at their expected return. In the equilibrium of the model, the individuals are segmented endogenously according to their wealth levels: the very poor and the rich are lenders and the intermediate individuals are borrowers. The poor undertake the backyard activity and the borrowers and the rich the entrepreneurial one. In Banerjee and Newman (1993)'s paper the poor remain poor, irrespective of their skill level, because the impossibility of borrowing forces them to occupational choices that do not correspond with their capabilities: all of the poor end up as wage labourers, mid-income individuals become self-employed, and the rich become labour employers. Inequality is perpetuated and resources get inefficiently allocated. To explain the evolution and the coexistence of debt and equity finance, Boyd and Smith (1998) develop a dynamic general equilibrium model in which producers of capital choose between two different types of technology that are financed in two different ways. The first, with a publicly observable low expected return, is financed by means of equity at no expense. The other, with non-observable (by lenders) high yield, is financed by means of debt subject to a standard costly state verification. There is thus a critical level of per capita income below which only a debt market exists. As capital accumulation takes place, the cost of state verification increases, due to a fall in the relative price of capital; a stock market then emerges as firms begin to make more use of the observable technology and less use of the unobservable technology, implying an increase in the amount of equity finance relative to debt finance.

This chapter is organized as follows. The next section is the theoretical model. In this section, we first find the equilibrium for two benchmark cases in which financial markets are either frictionless or completely closed down. As credit markets are often imperfect (arising from the moral hazard problem, for example) rather than frictionless or completely closed down, we then characterize two different financial institutions (namely the "formal" and the "informal" financial institutions) with different technologies in solving moral hazard problems, and derive their respective equilibriums. Finally, we allow for the coexistence of the two credit institutions, and show at equilibrium which individuals participate in which financial market, and what the efficiency and growth implications are of the coexistence of the two institutions. Section 4.3 contains the empirical evidence for rural China. We conclude in section 4.4.

4.2 The model

4.2.1 Key ingredients of the model

There are several stylized facts in rural areas of developing countries. The key ingredients and structure of our model are mainly abstracted from these stylized facts. We first list these facts and then explain their connection with the model.

- Agricultural activities are more likely to exhibit diminishing marginal returns;
- Rural production activities need less set-up investment compared with the urban ones;
- Asymmetric information in credit markets prevails in the spatially large countryside; since banks have difficulty monitoring the activities undertaken by borrowers, they often require collateral; at the same time, the informal credit market is often prevalent in rural areas of developing countries;
- The rural household is both a consumption unit and a production unit.

In the pioneering investigation carried out at northern Thai villages by Townsend (1995), his fundamental basis for theoretical inference is decreasing returns to capital investment. He argues that agricultural production activities have the prominent nature of diminishing marginal returns to capital. In our model, diminishing returns to capital investment also play a prominent role. Our basic idea is as follows. Diminishing marginal returns to capital input means that at low investment levels marginal returns are high. From the social point of view, the poor's production increase from one additional unit of investment will sufficiently compensate the rich's production loss from the one unit decrease of investment. However, if credit constraints prevent the agents from smoothing their differences of investment, then inequality will harm growth.

It is also easily observed and understood that rural activities require less set-up capital compared with modern factories. Correspondingly, our model assumes convexity of the production set. If, instead, investment involves a minimum project size, generating a threshold level of wealth below which agents do not invest, then the poor will be excluded from investment because of this barrier. Then wealth concentration helping more individuals go beyond the threshold wealth level could be growth-enhancing, implying that

inequality could positively effect growth. However, what we want to focus on here is the credit constraints instead of the minimum sunk capital constraints. Non-convexity is the assumption in Aghion and Bolton (1997) and Galor and Zeira (1993). Furthermore, non-convexity is also originally seen as a key ingredient in models with explicit credit rationing. In this chapter, there is no credit rationing analyzed[2].

As far as rural credit markets are concerned, much of the existing literature argues similarly (see Hoff and Stiglitz, 1990) – that banks in rural areas have found it difficult to screen and monitor borrowers directly, and therefore rely heavily on collateral[3]. Informal intermediaries are also popular in rural areas. Paulson and Townsend (2001) show that the average per capita income of households or entrepreneurs borrowing in the formal sector seems to be larger than that of agents borrowing in the informal sector, and the rates charged to the latter borrowers are higher than those charged to the formal sector"s entrepreneurs. Bouman (1989) argues that the prevalence of the informal credit market is the self-response of the "penny" rural economy. In our model, both asymmetric information in credit markets and the coexistence of "formal"and "informal"credit markets are ingredients. There are many ways to model the imperfections of credit markets. We will consider problems created by moral hazard. This simplification makes the coexistence of formal and informal credit markets tractable. Given the characteristics of formal and informal credit markets respectively, we show that the emergence of the informal credit market is fully endogenous in our model.

Our model is based on household-production activity, which is in line with the last stylized fact in rural areas. But why don't rural households pool their capital? Diminishing returns can basically offer the answer. Townsend (1995) provides evidence of the decreasing returns that are central to the resulting inefficiency: both in developing and developed rural areas, the household is usually the most efficient unit of production. Similarly, another question arises: why can't one household hire the labor of others? There are many justifications for this simplification, including the problem of labor contract enforcement in rural areas, the particular difficulties in monitoring between principal (employer) and agent (employee) in agricultural activities, and the great distances between households. Although the production and consumption of individual households are separated in terms of the possibility of

[2]In our model specified soon, banks ask for collateral to solve moral hazard problems. We assume that collateral is perfectly observable by the banks. This provides another reason why there is no credit rationing in our model.

[3]Siamwalla et al. (1990)'s paper shows the importance of land as collateral in rural formal finance, "the sphere of operation of commercial banks and cooperatives... has been almost exclusively in the villages where land titles have been issued".

pooling labor and capital input, there is still one connecting point across them: the credit market – if they have access to it.

4.2.2 Set-up

Household

We consider a closed economy with an infinite, discrete time horizon, $t = 0, 1, 2, ...$ This economy features one homogeneous good that serves both as capital and consumption good. There are non-altruistic overlapping generations. Both generations have mass of 1 and remain constant in size over time. The generation born at the beginning of period t is called generation t, and is young during period t. Generation t becomes old in period $t + 1$ and dies, exiting the model at the end of period $t + 1$. A new generation $t + 1$ is born in period $t + 1$. A continuum of households, indexed by $i \in [0, 1]$, lives in this economy. At time t, each household therefore is comprised of two persons: the old $(t - 1)$ generation and the young (t) generation.

Assume that each household produces separately (i.e., each household is one production unit, and households do not pool their own capital and labor). At time t, the old's capital and the young's labor are combined for household-level production. The young gets her labor income and the old gets his capital income. Assume the young consumes only when she is old, and thus saves all of her wage payment of the current period as capital input of the next period. Moreover, to maximize the expected second-period consumption, young people also could borrow and lend among themselves. When $t+1$ arrives, young people become old and consume after the payment of wage bills to the new-born young and the payment on intragenerational borrowing and lending.

Technology

The production function[4] is identical for all households and has the Cobb-Douglas form

$$y_{t,i} = s(w_{t,i})^{\alpha} l_{t,i}^{1-\alpha} y_{t-1}^{1-\alpha} \tag{4.1}$$

$t = 0, 1, 2, ...t, t + 1...$ Here, s is constant[5]. $0 < \alpha < 1$. $w_{t,i}$ is household i's capital input saved from the wage income of the young generation $t - 1$. $l_{t,i}$

[4] We will introduce risks in production later.

[5] It will be shown soon that the aggregate economic growth rate of the economy can be positive if s is sufficiently large (see footnote 10). Therefore, we put s into the production function to make the growth rate of the economy more reasonable.

is the young generation t's labor input supplied inelastically ($i.e. l_{t,i} = 1$, for all t and i).

Two points are worth mentioning. First, we assume that all households have an identical production function to capture the idea that investment *opportunity* is equally distributed. We can thus focus on how capital *level* inequality can generate motivation for intragenerational borrowing and lending and how capital inequality could possibly affect economic growth. Second, this production function implies that each household incorporates the aggregate production level of the previous period as one common production factor. This specification could be justified by "spill-over" effects between two consecutive periods; the previous production thus affects the common production condition for the current period[6].

Risks in production and the moral hazard problem

Assume that when t arrives[7] the household level capital endowment $w_{t,i}$ is observable to all households and financial intermediaries. Given $w_{t,i}$, households undertake production activity. When intragenerational borrowing and lending is possible, each household's realized capital input can come from two sources: the household's own period beginning capital $w_{t,i}$ and external borrowing (lending), denoted by b_i, from (to) other households ($b_i \geq 0$ corresponds with borrowing; otherwise lending). The realized capital input (denoted by $k_{t,i}$) of household i is thus

$$k_{t,i} = w_{t,i} + b_{t,i} \tag{4.2}$$

After completion of the production, the old get the capital income. Their consumption is the capital income minus a financial payment due to borrowing or lending (financial payment is positive when borrowing happens; otherwise negative).

We further assume that production risks exist at the household level: with certain probability the production activity fails and there is no output. The law of large numbers leads to no risk existing at the aggregate level. Moreover, the household's production is possibly subject to a moral hazard problem, like in Holmstrom and Tirole (1997). Taking risk and moral hazard possibility into consideration, the household level production function can be specified as follows.

An household can choose between two projects: the less risky project and the more risky one. The two projects differ not only because one has a higher

[6] This specification could make growth rate calculation easier.

[7] In the appendix, we caculate the dynamic capital linkage at the beginning of each period of this economy.

probability of failure, but also because only the more risky project offers a private benefit θ. We depart from Holmstrom and Tirole (1997) by assuming that the private benefit is received only if the project is successful.

The less risky project (denoted by "S", referring to "safe"):

$$y_{t,i} = \begin{cases} sk_{t,i}^{\alpha} l_{t,i}^{1-\alpha} y_{t-1}^{1-\alpha} \text{with probability } p \\ 0 \text{ with probability } 1-p \end{cases}$$

The more risky project (denoted by "R", referring to "risky"):

$$y_{t,i} = \begin{cases} sk_{t,i}^{\alpha} l_{t,i}^{1-\alpha} [y_{t-1}^{1-\alpha} + \theta] \text{ with probability } q \\ 0 \text{ with probability } 1-q \end{cases}$$

Here we assume $p > q$, capturing the risk difference of the two projects. The private benefit ($\theta > 0$) can be interpreted alternatively as opportunity costs from managing the project diligently, which increases the probability of success from q to p. Because project choices are the same among households, there is no adverse selection problem. Only incentive issues need to be considered.

Consumption

In general for the production function taking Cobb-Douglas form, capital and labor income are α and $1-\alpha$ share, respectively, of output. Although production risks exist in this chapter's setup, we assume that the young get certain wage equal to the expected value of marginal product of labor ($(1-\alpha)$ share of the expected output) regardless the possible state of nature[8]. Given $w_{t,i}$ and $b_{t,i}$, the expected consumption of the old from undertaking the "safe" project (S project) and the "risky" project (R project) is thus the α share of the output net of financial payment, i.e.:

$$c_{t,i}^{s} = sp\alpha(w_{t,i} + b_{t,i})^{\alpha} l_{t,i}^{1-\alpha} y_{t-1}^{1-\alpha} - pb_{t,i}R_t$$

and

$$c_{t,i}^{R} = sq\alpha(w_{t,i} + b_{t,i})^{\alpha} l_{t,i}^{1-\alpha} (y_{t-1}^{1-\alpha} + \theta) - qb_{t,i}R_t$$

Here R_t is the interest rate required by financial intermediaries' loans. Because $l_{t,i} = 1$, the above equation could be simplified as

[8]Implicitly, we assume that there are perfect insurance markets that ensure the labor income of the young. This is a strong assumption. We assume there is no moral hazard on the part of the young. Hence, this could be reasonable.

$$c^s_{t,i} = sp\alpha(w_{t,i} + b_{t,i})^\alpha y^{1-\alpha}_{t-1} - pb_{t,i}R_t$$

and

$$c^R_{t,i} = sq\alpha(w_{t,i} + b_{t,i})^\alpha (y^{1-\alpha}_{t-1} + \theta) - qb_{t,i}R_t$$

We make two assumptions about the size of these two expected consumption equations.

Assumption (1)

For any $w_{t,i}$, when $b_{t,i} = 0, c^s_{t,i} > c^R_{t,i}$. At any wealth levels, when there is no borrowing or lending, the expected consumption from taking the safe project is larger than that from the risky project. Therefore, without borrowing and lending (so that households finance their investment only by their own capital), all households automatically choose the safe project. Simplifying this assumption, we get

$$py^{1-\alpha}_{t-1} > q[y^{1-\alpha}_{t-1} + \theta].$$

One immediate result of this assumption is that if $b_{t,i} < 0$, $c^s_{t,i} > c^R_{t,i}$.[9] Thus, any lenders will automatically choose the safe project and only borrowers can have incentives to choose the risky project. Assumption (1) restricts moral hazard problems only to borrowers.

Assumption (2)

For given $w_{t,i}$,

$$\frac{\partial c^s_{t,i}}{\partial b_{t,i}} < \frac{\partial c^R_{t,i}}{\partial b_{t,i}}$$

Calculating this relationship, we get

$$sp\alpha^2(w_{t,i} + b_{t,i})^{\alpha-1} y^{1-\alpha}_{t-1} - pR_t < sq\alpha^2(w_{t,i} + b_{t,i})^{\alpha-1}[y^{1-\alpha}_{t-1} + \theta] - qR_t$$

An additional unit of borrowing invested into a risky project yields higher additional consumption than the same unit invested into the safe project.

Although by assumption (1) both lenders and neither-borrower-nor-lender automatically choose the safe project, borrowers could prefer to choose the risky project, due to assumption (2) when the borrowing amount is sufficiently high. Assumption (2) therefore assures that the moral hazard problem exists.

Figure 4.1 presents assumptions (1) and (2) graphically. It shows for a given wealth level how the expected consumption when undertaking safe and

[9] This is because $p > q$.

risky (line "S" and line "R") projects changes with respect to b. In this figure, line "S" crosses the vertical axis (which corresponds to $b_i = 0$) at point A, which is above the crossing point B of line "R". Moreover, line "S" is less steep than line "R". As a result, line "S" lies above line "R" whenever $b_i < 0$; but when $b_i > 0$, line "S" lies above line "R" only up to certain amount of borrowing (b_1 in the figure).

Financial intermediary

A financial intermediary exists in this economy to channel funds from lenders to borrowers. Since a moral hazard problem exists, the financial intermediary, apart from channelling funds, will also need to play a role in solving the moral hazard problem. The financial intermediary could rely on different technologies to solve the moral hazard problem, according to which we distinguish two different financial intermediaries: the "formal" one and the "informal" one. Before making this distinction, we first study two extreme cases.

4.2.3 Two extreme cases

The perfect credit market

In general, when the credit market is perfect, there are neither transaction costs nor information costs. Within the framework of the model's set-up, we regard perfect credit markets as a particular case in which the one that financial intermediaries can monitor the projects undertaken by the borrowers perfectly and costlessly. The perfect monitoring ability will force the borrowers to undertake the safe project. As far as lenders are concerned, they will automatically, by assumption (1), undertake the safe project. All households will therefore choose the safe project when the credit market is perfect.

The perfect credit market equilibrium can be defined as

(a). Households maximize expected consumption

Household i with capital $w_{t,i}$ chooses $b_{t,i}$ to maximize the expected consumption from undertaking the safe project, i.e.

$$\max c^s_{t,i} = sp\alpha(w_{t,i} + b_{t,i})^\alpha y_{t-1}^{1-\alpha} - pb_{t,i}R_t$$

for all i.

(b). Market-clearing condition

$$\int_0^1 b_{t,i}di = 0$$

We obtain the following proposition similar to Ahgion et al. (1998).

Proposition 4.1 *In the perfect credit market equilibrium, all households end up investing the same amount* $w_{t,i} + b_{t,i} \equiv \bar{k}_t = (1-\alpha)y_{t-1}$ *(for all i), regardless of the distribution of capital at the beginning of the period across households. The growth rate of this economy is* $\ln sp\alpha + \alpha \ln(1-\alpha)$, *which is also independent of the initial distribution of capital.*

Proof. *see appendix.* ■

By this proposition, $\frac{\partial(w_{t,i}+b_{t,i})}{\partial w_{t,i}} = 0$ and $\frac{\partial b_{t,i}}{\partial w_{t,i}} < 0$. The investment level is the same for the households. The poor households with $w_{t,i} < (1-\alpha)y_{t-1}$ are borrowers, and the poorer the household is, the more it will borrow. The wealthy households with $w_{t,i} > (1-\alpha)y_{t-1}$ are lenders, and the wealthier the household is, the more it will lend. The perfect credit market fully equalizes the investment level of the poor and the rich.

When the credit market is perfect, the growth rate of this economy is constant[10], independent of the wealth distribution. Therefore, when the credit market is perfect, the change of initial capital distribution has only individual household welfare implications and has no effects on aggregate economic growth.

Closing down the credit market

Conversely, when credit markets are highly imperfect and credit therefore is scarce and costly, equilibrium investments will remain unequal across households. Consider the extreme situation in which the credit market is completely closed down, and borrowing and lending are simply not possible. This situation can happen if, for example, there is a severe contract enforcement problem. In this situation, all households have to fully self-finance their investment from their own initial capital. By assumption (1), all households then prefer to choose the safe project.

Proposition 4.2 *If there is no credit market at all, investment levels across households will be unequal and be the same as their initial own capital. Not only does the initial capital distribution matter for economic growth, but also the more unequal distribution of initial capital is, the lower the rate of economic growth will be.*

Proof. *see appendix.* ■

As explained at set-up, the distribution of $\varepsilon_{t,i}$ can be viewed as the indicator of capital distribution inequality. Since $\alpha < 1, (\varepsilon_{t,i})^\alpha$ is a concave

[10] The growth rate is positive when $sp\alpha(1-\alpha)^\alpha > 1$, i.e., when $s > \frac{1}{p\alpha(1-\alpha)^\alpha}$.

function. Moreover, $\int_0^1 \varepsilon_{t,i} di = 1$. Therefore (see equation (4.17)), greater inequality between individual investments for a given aggregate capital stock (here $\int_0^1 w_{t,i} di = (1-\alpha) y_{t-1}$) will reduce aggregate output and the economic growth rate. Not surprisingly, the economic growth rate in the economy without a credit market is smaller than the growth rate in the economy featuring a perfect credit market.

We could intuitively explain the negative relationship between inequality and growth when the credit market is closed. Without the possibility of borrowing and lending, unequal distribution of capital and the resultant unequal levels of investment underutilises the poor's productivity, whereas it overutilises the rich's one from the socially optimal point of view. To show this, we compare the investment level of this case with the investment level of the perfect credit market case (which can be considered as the socially optimal result[11]). See equations (4.14) and (4.16): the poorer the household is, the lower its investment compared with the perfect credit market case, and the higher the marginal productivity of its investment; the richer the household is, the higher its investment compared with the perfect credit market case, and the lower the marginal productivity of its investment.

4.2.4 The "formal" credit market

Assumption (2) gives rise to moral hazard problems of borrowers of big amounts (i.e., when the desired borrowing amount is sufficiently high and a borrower successfully obtains it, without effective monitoring by the financial intermediary, the borrower prefers to choose the risky project. This section characterizes one kind of technology to overcome this moral hazard problem. This kind of financial intermediary is not able to monitor borrowers due to infinite monitoring costs. The infinity of monitoring costs of the intermediary could be either because of the large scale of transaction volume, limiting the intermediary's capacity of monitoring each transaction), or because of long geographic distances between intermediary and the borrower. This kind of financial intermediary therefore requires borrowers to provide collateral to serve as an incentive mechanism, inducing the borrowers that are prone to choose the high-risk project to select the safe project.

In reality, banks often ask borrowers to provide collateral, and particularly in rural areas the dispersed locations of households make it difficulty for banks to monitor borrowers directly and effectively. Banks are therefore the main form of financial intermediary analyzed here.

[11] So, the central planner can redistribute w^i, such that $\varepsilon^i = 1$ for all i. The redistribution policy has the substitution function for the perfect capital market.

The problem is as follows:

$$\max_{b_{t,i}} \; sp\alpha(w_{t,i} + b_{t,i})^{\alpha} y_{t-1}^{1-\alpha} - pb_{t,i}R_t \tag{4.3}$$

Subject to

$$\text{(IC)} \; c_{t,i}^{s} \geqq c_{t,i}^{R} \tag{4.4}$$

$$\text{i.e., } sp\alpha(w_{t,i} + b_{t,i})^{\alpha} y_{t-1}^{1-\alpha} - pb_{t,i}R_t \geqq sq\alpha(w_{t,i} + b_{t,i})^{\alpha}(y_{t-1}^{1-\alpha} + \theta) - qb_{t,i}R_t$$

$$\text{(PC)} \; r_t \leqq pR_t$$

Young people choose the optimal amount of borrowing or lending to maximize their expected consumption when old. There are two constraints. The incentive compatibility (IC) constraint prevents borrowers from undertaking the risky project. The (IC) constraint says that the expected consumption from undertaking the safe project is larger than that obtained from the risky project. (PC) refers to the participation constraint of banks, in which r_t is the risk-free deposit interest rate and R_t is the interest rate charged on borrowers by banks. It basically says that the competitive banks[12] receive an expected profit no smaller than zero. At equilibrium, R_t will be set such that the (PC) binds and banks get zero profit. If the projects chosen by borrowers are risky ones, then the probability that banks get their loans payments back will be reduced to q, leading to a negative profit of banks. Therefore, the (IC) constraint is imposed by banks to ensure that borrowers will choose the relatively safe project. We assume that both households and banks are risk neutral.

Proposition 4.3 *In a "bank equilibrium", there exists two critical initial capital levels: $\bar{w}_t$ and $\underline{w}_t$. When $w_{t,i} \geq \bar{w}_t$, households are lenders and they have the same investment level. Lenders lend more if they initially have more capital; otherwise, households are borrowers.*

There are two types of borrowers. Relatively rich borrowers with capital $w_{t,i}$, such that $\bar{w}_t > w_{t,i} \geq \underline{w}_t$, are not financially constrained; they invest at the same level as lenders and borrow more if they have less capital. The relatively poor borrowers with capital $w_{t,i}$, such that $w_{t,i} < \underline{w}_t$, are financially constrained; they borrow and invest more only if they have more initial capital to provide as collateral.

[12] The precise structure of the market is unimportant for what follows, other than in determining the division of the surplus between the borrowers and banks.

Proof. *see appendix.* ■

This proposition says that (1) The rich young are lenders and the poor young are borrowers; (2) Among the borrowers, the relatively rich ones can freely borrow up to their desired amount, but the relatively poor ones can not and are financially constrained; (3) These financially constrained poor borrowers borrow and invest more if they have more capital. The reasonable explanation for the last point is that those who are less poor have more initial capital to serve as collateral in the asymmetric information credit market. Banks are thus willing to grant them more loans.

A careful examination of these financially constrained borrowers reveals an unfortunate situation: although the poorer individuals have a higher marginal product of capital, which means that it makes sense to grant them more loans from the socially optimal point of view, they are less able to get access to the credit market.

Lemma 4.4 *Compared with the perfect credit market equilibrium, when the credit market features asymmetric information and banks rely on collateral to provide incentives for borrowers to undertake safe projects, in the bank equilibrium the investment level of lenders and relatively rich borrowers (all are the same) is higher than that of the perfect credit market equilibrium. The equilibrium interest rate is lower than that of the perfect credit market equilibrium and the lender-borrower dividing capital level is higher than that of the perfect credit market equilibrium.*

Proof. *see appendix.* ■

This lemma says that the information asymmetries, if they exist in the credit market, reduce the aggregate financial activities. As a consequence, the investment levels of the lenders and the rich borrowers are higher than in the perfect credit market case; the marginal rate of return and the interest rate level are thus lower than in the perfect credit market case. Moreover, some of the lenders in the perfect credit market case become borrowers in the credit market with asymmetric information.

Lemma 4.5 *The severity of the moral hazard problem can be characterized by θ and $\frac{p}{q}$. The larger the θ and the closer $\frac{p}{q}$ towards 1, the more severe the moral hazard problem and the larger are $\bar{w}_t$ and $\underline{w}_t$. At the extreme, when θ goes to infinity or $\frac{p}{q}$ goes to 1, there will be no credit available in the economy, which proceeds to close down the credit market; At the other extreme (θ goes to zero or $\frac{p}{q}$ goes to infinity),we go back to the perfect credit market situation.*

Proof. *see appendix.* ■

As θ is the size of the private benefit when the borrower undertakes the risky project, given other conditions a larger θ leads to stronger incentives to undertake the risky project. The moral hazard problem becomes more severe. As a consequence, lending activities diminish, more households become borrowers ($\bar{w}_t$ increase) and more households become financially constrained ($\underline{w}_t$ increases). Interestingly, θ can not only be understood as an inherent characteristic of the projects themselves, but also can be interpreted as one measurement of the monitoring ability of banks: banks that can monitor the project thus reduce θ (see Holmstrom and Tirole, 1997). By this interpretation, the banks' enhanced monitoring ability reduces the severity of the moral hazard problem. As $\frac{p}{q}$ gets closer to 1, the "safety" difference between the two projects gets smaller, which leads to stronger incentives to undertake the risky project. At extremes of the values of θ and $\frac{p}{q}$, we go to either the perfect credit market situation or the no credit market situation.

Figure 4.2 compares this situation with the perfect market case. The imperfection of the credit market makes the critical value $\bar{w}_t$ move to the right of the mean wealth level $(1-\alpha)y_{t-1}$. Therefore, some of the lenders in the perfect credit market case become borrowers here. The investment level line (line k_f, segment MN) of the lenders and the rich borrowers in the formal credit market case lies above that in the perfect credit market case (line k_p, segment M'N'), as do the borrowing and lending lines (segment XY of line b_f and segment X'Y' of line b_p). The investment levels of poor borrowers (segment OM of line k_f) decrease with the capital levels (which is zero for households with zero capital). Their borrowing levels (segment OX of line b_f) also decrease to zero.

4.2.5 The "informal" credit market

We will now characterize the second kind of technology to mitigate the moral hazard problem, and call it the "informal" credit market. To keep the model simple, we do not consider the risk diversification role of the informal market (banks may allow better risk diversification) and the interaction between the formal-informal sector (see Pinaki Bose, 1998) for this consideration).

A special feature of the informal credit market is that the intermediaries in this market rely directly on monitoring activity, due to the small scale and the few transactions and the closer geographic proximity of borrowers, to solve the moral hazard problem – rather than on collateral (as banks do in the formal credit market). However, this monitoring activity is costly[13]

[13]The papers surveyed by Townsend (1995) broadly suggest that information at the village level may indeed be acquired at a cost.

(i.e., they observe at a cost whether or not the undertaker enjoys private benefits, and impose a large enough punishment, which makes choosing the risky project less preferable from the outset). Denote $C(l)$ as the monitoring cost when the loan size to be monitored is l. By spending $C(l)$, the intermediary can observe the project choice of borrowers and can ask them to undertake the safe project. Therefore, if borrowers can obtain a loan from the informal credit market, they will have to undertake the less risky project. For simplicity (similar to Holmstrom and Tirole, 1997), we assume that the cost function is linear in loan size,

$$C(l) = \pi l \tag{4.5}$$

Denote $r_t, R_t^{'}$ as the payment rate of lenders and borrowers, respectively, in the informal credit market. A no arbitrage condition requires that the lenders' risk-free deposit interest rate in the informal credit market is the same as the one in the formal credit market. The relationship between r_t and $R_t^{'}$ is established under the assumption of competitive informal intermediaries. The zero profit condition leads to

$$pR_t^{'}l = C(l) + r_t l \tag{4.6}$$

Therefore, the borrowing rate is

$$R_t^{'} = \frac{\pi + r_t}{p} \tag{4.7}$$

Proposition 4.6 *In the informal credit market equilibrium, two critical capital levels exist:* $\check{w}_t$ *and* $\hat{w}_t$. *When* $w_{t,i} \geq \check{w}_t$, *households are lenders, and they have the same investment level. Lenders lend more if they have more capital. When* $w_{t,i} \leqq \hat{w}_t$, *households are borrowers and they have the same investment level, which is smaller than that of lenders. Borrowers borrow more if they have less capital. The households with capital in between are neither borrowers nor lenders*[14]. *They financially stay in autarky and invest their capital in the safe project.*

Proof. *see appendix.* ■

This proposition tells us that (1) The rich young are lenders and the poor young are borrowers; (2) Due to the cost of monitoring, the middle

[14] In a Ricardian model with a constant unit labor requirement of n commodities, Dornbusch, et al. (1977) prove that international transport costs give rise to an intermediate range of commodities that are non-traded. The result obtained here basically shares a similar logic.

class households are financially autarkic; the measure of these households is a decreasing function of the monitoring cost parameter π. (3) Although some households are excluded from borrowing and lending activities, unlike in the formal credit market, the poor borrowers' borrowing ability is not restrained by their own capital (i.e., their ability to get access to the credit market is not constrained by their ability to provide collateral).

Lemma 4.7 *Compared with the perfect credit market equilibrium, in the informal credit market equilibrium, which features asymmetric information in the credit market and directly monitoring of production by informal financial intermediary at a cost, the investment level of lenders is higher than in the perfect credit market equilibrium; the investment level of borrowers and the equilibrium interest rate are also lower.*

Proof. *see appendix.* ■

Again, this lemma says that the information asymmetries, if they exist in the credit market, reduce the aggregate financial activities. As a consequence, the investment level of the lenders is higher than in the perfect credit market case (lenders can lend below the socially optimal level). The investment level of the borrowers is also lower than in the perfect credit market case and some of the borrowers and lenders in the perfect credit market case become financially autarkic in the situation of a credit market with asymmetric information.

Lemma 4.8 *When π approaches zero, the result corresponds to that of the perfect credit market case; When π approaches infinity, the result corresponds to the case of closing down the credit market.*

Proof. *see appendix.* ■

Figure 4.3 compares this situation with the perfect market case. The bold lines k_i and b_i are investment and borrowing lines, respectively, in the informal credit market. $\check{w}_t$ and $\hat{w}_t$ are critical capital levels.

4.2.6 Coexistence of the "formal" and "informal" credit markets

If only the formal credit market exists**,** we obtain the following result for households with $w_{t,i} < \underline{w}_t$ (see the proof of proposition 4.3)

$$sp\alpha^2(w_{t,i} + b_{t,i})^{\alpha-1} y_{t-1}^{1-\alpha} - pR_t > 0$$

which says that the marginal product of capital of these households is bigger than the interest rate. Among these households, the poorest households undertake even less investment. Such a household's marginal product of capital will thus be even higher than the interest rate. If given one unit of additional loan, the household earns even more than the loan repayment. Those with initial capital $w_{t,i} < \underline{w}_t$ must therefore be eager to obtain more loans, if possible. What's more, the eagerness of the poorest households is the highest.

Thus, we expect the endogenous emergence of some other kinds of credit markets to meet their thirst. The poor are not able to get enough loans from the existing formal credit market because they don't have enough collateral. Thus the emerging credit market grants loans that are not based on collateral. The way we model the so-called informal credit market could be one choice. Now the two credit markets coexist. We first need to know who will go to what type of credit markets by value comparison. We then characterize the levels of investment and the borrowing or lending amount of all households.

Proposition 4.9 *In the coexistence equilibrium, the existence of the informal credit market increases the production activity of the poorest households who are financially constrained if only the formal credit market exists. Therefore, the coexistence of formal and informal credit markets leads to improved efficiency. Specifically, there exists a critical capital level $\tilde{w}_t < \hat{w}_t$ for all households with $w_{t,i} < \tilde{w}_t$; they borrow from the informal credit market rather than from the formal credit market. The poorest segment of households consequently gets around the no borrowing constraint.*

Proof. *see appendix.* ■

This proposition shows that the most disadvantaged households in the formal credit market will opt for informal financing. Although they have to pay a higher interest rate, their expected consumption is still higher by entering into the informal credit market than it would be by participating in the formal credit market.

Lemma 4.10 *The existence of the informal credit market increases the aggregate financial activities: more households become lenders, the lenders lend more than if only the formal credit market exists (thus have a low investment level), and the interest rate of the economy increases. There are still households (borrowers with intermediate capital levels, i.e., $\tilde{w}_t < w_{t,i} < \underline{w}_t$) who are financially constrained. The less costly the informal credit market (measured by the cost parameter π), the smaller the segment of the financially constrained households. At the extreme, when $\pi \to 0$, no households are financially constrained.*

Proof. *see appendix.* ■

Figure 4.4.1 shows the value functions of the formal and informal credit market cases and how households are segmented according to their capital levels. We see that the households with a capital level below $\tilde{w}_t$ will enter into the informal credit market. The bold lines in Figure 4.4.2 show how at equilibrium the borrowing (lending) levels and investment levels change with respect to capital. The existence of the informal credit market raises the borrowing levels and investment levels of all individuals with $w_{t,i} < \tilde{w}_t$. Because $\bar{w}_t$ and $\underline{w}_t$ are in fact endogenous to the existence of an informal credit market, Figure 4.4.2 shows who would want to enter the informal market, given that nobody else is in this market (hence for given $\bar{w}_t$ and $\underline{w}_t$).

Since the existence of the informal credit market releases some of the formerly financially constrained households, the aggregate growth rate of the economy when the formal and informal credit markets coexist will be higher than the growth rate if only the formal credit market exists.

4.3 Empirical evidence

A number of recent empirical studies on the relationship between inequality and economic growth were initiated from the puzzle raised by Lucas (1993)[15]. More evidence was then presented by Clarke (1992), and Persson and Tabellini (1994). Benabou (1996) made an intensive and extensive review of these findings. These empirical studies use cross-country regressions, however, which are unavoidably tangled with national, cultural, political and geographical disturbances – although some of these studies try to control for these disturbances by using geographical dummy variables (Deininger and Squire, 1998), for example. If it is possible, instead, to use cross-regional data within one single country, then these disadvantages associated with cross-country regressions could be lessened. Towards this end, this section will conduct cross-regional regressions using Chinese provincial data to check the inequality-growth relationship.

Three points must be mentioned at the outset. First, because we have to be more cautious of spatial autocorrelation[16] in cross-region regressions, we choose the Lagrangian multiplier error dependence test to ascertain its strength and to determine whether we need to take measures to correct it.

[15]Lucas pointed out a fact. In 1960, the Philippines and South Korea had about the same standard of living and many similar initial conditions. Yet, From 1960 to 1988, GDP per capita in the Philippines grew at about 1.8 percent per year, whereas GDP per capita grew at 6.2 percent per year in Korea. One proposed explanation on this huge difference is the initial income distribution effects. The high initial inequality (measured in many ways) in the Philippines is sharply opposite to the situation in Korea.

[16]For readers not familiar with spatial autocorrelation, see Anselin, L. (1988).

Second, similar to cross-country growth regressions, the concern is with the robustness of the results. In this exercise, we take the reasonable extreme bound analysis (Granger and Uhlig, 1990) approach for the purpose of sensitivity check. Third, we introduce dummy variable representing the different regional policy attitudes towards the informal credit market to know whether the empirical evidence can fit the theoretical model's predictions.

4.3.1 Data description

Most of the data (except the inequality measurement and the dummy variable) are from the China Statistical Yearbooks. The analyzed period starts in 1988 and lasts until 1997. The cross-sectional data are drawn from 22 provinces, three municipalities (such as Beijing) and four autonomous regions (Tibet, although an autonomous region, is excluded, due to missing data). The dependent variable is the average annual growth rate of rural household per capita net income from 1988 to 1997, denoted as *ANNUGROW*.

The explanatory variables are as follows:

GINI88: rural Gini coefficient in 1988 measured by a Lorenz curve (Zhu and Wen, 1994)

INVEST: average investment to GDP ratio from 1988 to 1997

LABGROW: average annual growth rate of rural labor from 1978 to 1987[17]

EDUCA88: average years of education received by rural labor force in 1988

LNFIXCAP: log value of productive fixed assets per capita in 1988

EMPLOY88: ratio of employee in TVE[18] (including part-time employee) to the total labor force in 1988

LNPOPU88: log amount of the total rural population in 1988

DUMMY: dummy is equal to 1, if the policy towards the informal rural credit market is relatively friendly or supportive, or if there is no stated or actual policy towards the informal rural credit market, or if there is policy, but the enforcement ability is very poor; otherwise, the dummy is equal to 0, if the policy attitude towards the informal credit market is hostile and there are visible and effective adverse impacts on the rural informal credit market due to the policy.

GINI88 is our focus variable. *INVEST* and *LABGROW* are meant to explain the role of different factor supplies. We use the labor growth rate ten years before in order to avoid endogenity problem. Since the saving tendency

[17] The reason for using ten years before is explained momentarily in this subsection.

[18] TVE means Township and Village Enterprises.

is relatively exogenous, *INVEST* (as defined by ratio to GDP) has less of an endogenity problem. *EDUCA88* is the initial human capital stock and *LNFIXCAP* is the initial physical capital stock. Both stocks capture the degree of relative maturity or backwardness. *EMPLOY88* has an approximate function to distinguish the strength of leading or lagging sectors. *LNPOPU88* is the indicator of the initial population size of the economy, which is expected to relate to market size, degree of externalities and so on. *DUMMY* is included to test empirically the role of the informal credit market on growth. See Table 4.1 for more detailed descriptions of data statistics.

4.3.2 The basic model

Besides *GINI88*, we will use *INVEST, LABGROW* and *EDUCA88* as the explanatory variables in the basic model. Specifically,

$$ANNUGROW_i = \beta_0 + \beta_1 GINI88_i + \beta_2 INVEST_i + \beta_3 LABGROW_i + \beta_4 EDUCA88_i$$

Table 4.2 displays the results. It shows that all explanatory variables are significant at the 5% level (except the constant). GINI88 has negative effects on economic growth. As we expect, the education level and the investment ratio have significant positive effects on the growth rate, as does labor supply. One concern is heteroskedasticity, which is tested for by using the Breusch-Pagan test. The H_o hypotheses (there is no heteroskedasticity) can't be rejected at the 5% level.

4.3.3 The full model

Reasonable extreme bounds analysis

Following the Barro-type growth model, the recent empirical literature on economic growth has identified a substantial number of variables that are related to the economic growth rate. One main problem in empirical growth models is that both the sign and significance of the "focus" variable are sensitive to the inclusion, or exclusion, of other explanatory variables (Sala-i-Martin, 1997; and Levine, 1992). This problem was pointed out initially by Leamer (1983). For clarity's sake, let us consider the following model:

$$y = \beta_I X_I + \boldsymbol{\beta}_B \mathbf{X}_B + \boldsymbol{\beta}_p \mathbf{X}_p + u \tag{4.8}$$

X_I is the variable of interest and β_I is the coefficient of interest. $\mathbf{X}_B$ is the vector of the variables that is to some degree generally accepted by many

econometric models. $\mathbf{X}_p$ is the subset of a variable pool. The variable pool includes the variables potentially related to the dependent variable or ones that are less accepted. u is $N(0, \sigma^2\Omega)$. When all of these three kinds of variables have been included into the regression, we obtain the full model. It comes as no surprise that the focus coefficient β_I varies with respect to changes in the combinations of $\mathbf{X}_p$.

An initial answer to this question was given by Leamer himself. He took the extremes taken by the alternative specification as the "extreme bounds". The extent of these bounds are considered as measurements of the fragility of the estimate of β_I (as alternative specifications are used). One criticism of the use of extreme bounds, however, is that the actual extremes may come from models that most economists would find unreasonable in some way. An example: extremes could be obtained from the specification having a lower R^2 (goodness-of-fit) value. This consideration leads us to revisit the paper by Granger and Uhlig (1990). In their original work, they restrict the range of reasonable specifications by placing a restriction on R^2[19].

It is commonly known that the basic model has the lowest $R^2_{\min}$ value due to fewer variables included, whereas the full model generates the highest $R^2_{\max}$. It may be thought that specifications that achieve R^2 values not too far from $R^2_{\max}$ would produce narrower extreme bounds for β_I. Grange and Uhlig consider model specifications achieving R^2 values greater than or equal to

$$R^2_\delta = (1-\delta)R^2_{\max} + \delta R^2_{\min} \tag{4.9}$$

For small δ, these model specifications may be considered as being "reasonable" specifications because they are not far away from the best "full" model in terms of goodness-of-fit.

The full model setup

In order to set up the full model and to conduct sensitivity analysis, we carefully choose four other variables, all of which are relatively significant and have different explanatory angles. The four variables: *LNFIXCAP, EMPLOY88, LNPOPU88* and *DUMMY.*

[19] Granger and Uhlig don't argue that R^2 is an ideal measure of the quality of the model, but they do state that it is a possibly relevant statistic and that some exact results are achievable by using it.

$$ANNUGROW_i = \beta_0 + \beta_1 GINI88_i + \beta_2 INVEST_i + \beta_3 LABGROW_i + \beta_4 EDUCA88_i + \beta_5 LNFIXCAP_i + \beta_6 EMPLOY88_i + \beta_7 LNPOPU88_i + \beta_8 DUMMY_i$$

Now we arrive at the full model. Table 4.3 shows the results, which indicate that the basic four variables still have the same sign and remain significant at 10%. As the indicator of the initial capital stock per capita, LNFIXCAP has a positive effect on long-run growth. This result shows that in the more mature areas as measured by per capita fixed assets will have higher growth. Initial population size has a significant positive effect on growth. Finally, the policy dummy has a positive sign. This shows that in rural China for the period from 1988 until 1997 the informal credit market had a somewhat positive effect on growth. In provinces with a hostile policy toward the informal credit market the growth rate would be lower, holding other variables constant.

Spatial autocorrelation

Before conducting the reasonable extreme bound analysis, we will check the validity of the assumptions underlying the full regression model. Three things are important: the normal distribution of residuals, homoskedasiticity and spatial autocorrelation. The histogram of residuals from the full model allow us to see, approximately, that the residuals are normally distributed. Again, we use the Breusch-Pagan test to check the H_0 hypothesis of homoskedasticity, and find that we can accept it. The third consideration is spatial autocorrelation, which is considered to be at the core of the disciplines of regional science and geography.

To this end we will in this exercise use the popular test, the Lagrangian Multiplier Error Dependence. For simplicity, we will use the contiguity or connectivity matrix as spatial weights matrix **W**. In this matrix, each observation is represented both as a row and as a column. In each row, the non-zero column elements correspond to contiguous regions. This simplification means that only the "contiguous border" is important. Furthermore, we will assign the same weight to each region contiguous to a considered region. Due to these two simplifications, the sum of each row of W is 1, and the non-zero elements in each row are equal. An example: the first row of this spatial weights matrix is for Beijing, which looks like

$$(0 \ \frac{1}{2} \ \frac{1}{2} \ 0 \ 0 \ ... \ ... \ 0)$$

Beijing has two contiguous provinces, Tianjing and Hebei, numbered as the second and third observations, respectively. Both of these two continuous provinces have been assigned equal weights. The LM-ERR statistic is distributed as χ^2 with one degree of freedom. The statistic value for the full model is 2.879, which is smaller than the critical value at 5%. We will accept the H_0 that there is no spatial autocorrelation, indicating that the Chinese rural areas of each province are relatively independent of each other.

Sensitivity analysis

This section employs the reasonable extreme bound analysis as the approach in sensitivity analysis. Table 4.4 is the result. We know that the focus coefficient remains the same sign when R^2 is at the top 10% level ($\delta = 0.1$) and top 40% ($\delta = 0.4$) level. The same result holds in the conventional unrestricted extreme bound analysis($\delta = 1.0$)[20]. These results confirm a robust and negative relationship between initial inequality and growth.

4.4 Discussion and conclusions

This chapter aims at building up a rural-specific model to analyze how inequality can negatively affect economic growth when the credit market is of imperfection due to the information asymmetry problem. The main conclusion of the model is as follows. First, the imperfection of credit market tends to result in overinvestment of the rich and underinvestment of the poor, shrinkage of the total credit activity and an increase of the equilibrium interest rate. When the imperfection is so strong that the credit market is completely closed down, these effects are strongest. When financial institutions (it doesn't matter whether they are formal or informal financial institutions) exist to help solve the information asymmetry problem, these effects are lessened but still exist. Second, both kinds of financial institutions favor or disfavor certain segments of households. Specifically, the reliance of the formal credit market on collateral provision leads to the poor becoming financially constrained, since they do not have enough own capital to be invested in the project. The more severe the moral hazard problem, as measured by the size of the private benefit and the closeness of the success probability of the risky and the safe project, the more the disfavored poor will become financially constrained. Reliance of the informal financial institutions

[20] $\delta = 0$ corresponds to only one specification: the full model. Therefore, the upper and lower bounds of *GINI88* are the same. Both are equal to the coefficient of *GINI88* in Table 4.3.

on direct monitoring rather than on collateral favors the poor relatively and helps them mitigate the financial constraint. However, since their monitoring activity is not free, the informal financial institution leads to some of the intermediate households staying in financial autarky. Since these households may raise financing up to the desired level from formal credit institutions without paying any additional monitoring costs, they may be disfavored by the informal financial institution. Third, the co-existence of the formal and informal credit institutions could therefore combine the advantages of the two institutions, thereby enhancing efficiency and economic growth.

We have not done much work on the dynamics of distribution under the contexts with various credit institutions because the main focus of the chapter is to study, given a certain distribution, the efficiency and growth implications of the co-existence of formal and informal credit. Some papers try to understand the relationship between inequality (poverty), the financial market, and economic growth. Greenwood and Jovanovic (1990) develop a model that predicts a nonlinear relationship between financial development and income inequality during the process of economic development. At early stages of development, only the rich can afford to access and profit from financial markets, so that financial development intensifies income inequality. At higher levels of economic development, financial development helps an increasing proportion of society, thereby reducing inequality. Aghion and Bolton (1997) also show in their "trickle-down" model that the process of capital accumulation initially has the effect of widening inequalities; in later stages, however, it reduces them, mimicking a "Kuznets curve". Beck, et al. (2004) use a cross-country sample to study empirically whether financial development disproportionately raises the incomes of the poor and alleviates poverty. They found that countries with better-developed financial intermediaries experience more rapid declines in measures of both poverty and income inequality.

Within this chapter's current context, we can point out some preliminary dynamic implications of the model. When the credit market is perfect, we see that all households, regardless of their initial capital endowments, will end up at the same first-best investment level, leading to the same wage income of the young and the completely equal capital endowment of the next period. Therefore, when the credit market is perfect, the inequality could only last for one period, and the economy will quickly converge to a completely equal society. When only the formal credit market operates, because borrowers who have enough wealth to put up as collateral can obtain credit up to the desired amount and earn more income as a result, existing capital asset inequality within the borrowing class could be projected and possibly magnified into the future, a phenomenon that may cause the persistence of

poverty (also see Mookherjee and Ray, 1999). A full workout of the dynamic version of our model would provide answers to (a) How does the evolution of the formal-informal financial structure depend on the initial distribution of wealth? (b) How is the evolution of wealth distribution influenced by the development of financial markets? (c) How do capital market imperfections affect income inequality? It is clear that these answers would depend on the initial aggregate endowment, on its distribution, and the specific characteristics of the financial institutions operating in the economy.

The empirical analyses in the chapter are more like a test of the general relationship between distribution and growth, rather than a specifically devised check of a particular mechanism highlighted by the model relating inequality with growth: the credit market imperfections and segmentations. Although we include the policy attitude dummy variable into the regressions, this is far from sufficient towards this end. More precise and detailed empirical work is thus needed, given the availability of data. There are several proposals for the future: to check whether a positive relationship exists between distribution and the informal credit market share of the entire credit market; to find appropriate measurements of the degree of credit market imperfections and to test whether the less the severity of this problem, the less the negative impacts will be from inequality on growth; to get survey data – for example, on who gets what kind of finance in rural China, in order to check the credit market segmentation hypothesis.

Appendix to Chapter 4

4A Proofs

The capital distribution dynamics

Proof. At time 0, the old person of household i has initial capital endowment $w_{0,i}$, which is a share $\varepsilon_{0,i}$ of the initial aggregate capital endowments:

$$w_{0,i} = \varepsilon_{0,i} y_{-1} \tag{4.10}$$

The distribution of $\varepsilon_{0,i}$ could be a measure of initial endowment inequality. By definition, $\int_0^1 \varepsilon_{0,i} di = 1$. $w_{0,i}$ owned by the old is supplied as capital input for production purposes and the young supply labor inelastically. The production function is

$$y_{0,i} = s w_{0,i}^{\alpha} l_{0,i}^{1-\alpha} y_{-1}^{1-\alpha}$$

For a homogeneous production function of degree one, the wage payment to the young simply equals to the labor share of total production, i.e. $(1-\alpha)y_{0,i}$. The young save all of their labor income as the next-period capital input $w_{1,i}$,i.e.,

$$w_{1,i} = (1-\alpha) y_{0,i} = (1-\alpha) s w_{0,i}^{\alpha} l_{0,i}^{1-\alpha} y_{-1}^{1-\alpha} \tag{4.11}$$

Since labor is suppled inelastically, $l_{0,i} = 1$ (for all i). Substituting $l_{0,i} = 1$ and (4.10) into equation (4.11), we get

$$w_{1,i} = (1-\alpha) s (\varepsilon_{0,i} w_0)^{\alpha} y_{-1}^{1-\alpha} = (1-\alpha) s \varepsilon_{0,i}^{\alpha} y_{-1} \tag{4.12}$$

The aggregate output of period 0 is

$$y_0 = \int_0^1 y_{0,i} di = \int_0^1 s k_{0,i}^{\alpha} l_{0,i}^{1-\alpha} y_{-1}^{1-\alpha} di = s y_{-1} \int_0^1 \varepsilon_{0,i}^{\alpha} di \tag{4.13}$$

By (4.12) and (4.13), we get

$$w_{1,i} = (1-\alpha) \frac{\varepsilon_{0,i}^{\alpha}}{\int_0^1 \varepsilon_{0,i}^{\alpha} di} y_0$$

Let $\varepsilon_{1,i} = \frac{\varepsilon_{0,i}^{\alpha}}{\int_0^1 \varepsilon_{0,i}^{\alpha} di}$. Then

$$w_{1,i} = \varepsilon_{1,i} (1-\alpha) y_0$$

Following the similar procedure, we get

$$\varepsilon_{2,i} = \frac{\varepsilon_{0,i}^{\alpha^2}}{\int_0^1 \varepsilon_{0,i}^{\alpha^2} di}$$

and

$$w_{2,i} = \varepsilon_{2,i}(1-\alpha)y_1 = \frac{\varepsilon_{0,i}^{\alpha^2}}{\int_0^1 \varepsilon_{0,i}^{\alpha^2} di}(1-\alpha)y_1$$

In general,

$$\varepsilon_{t,i} = \frac{\varepsilon_{0,i}^{\alpha^t}}{\int_0^1 \varepsilon_{0,i}^{\alpha^t} di}$$

and

$$w_{t,i} = \varepsilon_{t,i}(1-\alpha)y_{t-1} = \frac{\varepsilon_{0,i}^{\alpha^t}}{\int_0^1 \varepsilon_{0,i}^{\alpha^t} di}(1-\alpha)y_{t-1}$$

We also have

$$\int_0^1 w_{t,i} di = \int_0^1 \frac{\varepsilon_{0,i}^{\alpha^t}}{\int_0^1 \varepsilon_{0,i}^{\alpha^t} di}(1-\alpha)y_{t-1} = (1-\alpha)y_{t-1}$$

The aggregate capital supply is the labor share of the previous period's aggregate output (i.e., the aggregate saving rate is $(1-\alpha)$). ■

Proposition 4.1

Proof. Household i with initial capital $w_{t,i}$ chooses $b_{t,i}$ to maximize the expected consumption from the safe project, i.e.,

$$\max c_{t,i}^s = sp\alpha(w_{t,i} + b_{t,i})^\alpha y_{t-1}^{1-\alpha} - pb_{t,i}R_t$$

FOC with respect to $b_{t,i}$ is

$$sp\alpha^2(w_{t,i} + b_{t,i})^{\alpha-1} y_{t-1}^{1-\alpha} = pR_t$$

Then,

$$b_{t,i} = (\frac{s\alpha^2}{R_t})^{\frac{1}{1-\alpha}} y_{t-1} - w_{t,i}$$

Using the loan market clearing condition $\int_0^1 b_{t,i} di = 0$, we get

$$\int_0^1 [(\frac{s\alpha^2}{R_t})^{\frac{1}{1-\alpha}} y_{t-1} - w_{t,i}] di = 0$$

Since $\int_0^1 w_{t,i} di = (1-\alpha)y_{t-1}$,we get

$$R_t = \frac{s\alpha^2}{(1-\alpha)^{1-\alpha}}$$

Therefore,

$$b_{t,i} = (1-\alpha)y_{t-1} - w_{t,i}$$
$$b_{t,i} + w_{t,i} = (1-\alpha)y_{t-1} = \bar{k}_t \tag{4.14}$$

The growth rate is as follows:

$$g_t = \ln \frac{y_t}{y_{t-1}} = \ln \frac{\int_0^1 sp\alpha(w_{t,i} + b_{t,i})^\alpha y_{t-1}^{1-\alpha} di}{y_{t-1}} = \ln sp\alpha + \alpha \ln(1-\alpha) \tag{4.15}$$

■

Proposition 4.2

Proof. By assumption (1), when there is no borrowing and lending, all households choose the safe project in which to invest, and the household's investment level is the same, i.e.,

$$k_{t,i} = w_{t,i} \tag{4.16}$$

Household i's expected consumption is

$$c_{t,i}^s = sp\alpha(w_{t,i})^\alpha y_{t-1}^{1-\alpha}$$

The aggregate production is

$$y_t = \int_0^1 sp\alpha(w_{t,i})^\alpha y_{t-1}^{1-\alpha} di = sp\alpha(1-\alpha)^\alpha y_{t-1} \int_0^1 (\varepsilon_{t,i})^\alpha di$$

The economic growth rate is

$$g_t = \ln \frac{y_t}{y_{t-1}} = \ln \frac{sp\alpha(1-\alpha)^\alpha y_{t-1} \int_0^1 (\varepsilon_{t,i})^\alpha di}{y_{t-1}} = \ln sp\alpha + \alpha \ln(1-\alpha) + \ln \int_0^1 (\varepsilon_{t,i})^\alpha di \tag{4.17}$$

Since $\alpha < 1$ and $\int_0^1 \varepsilon_{t,i} di = 1$, $\int_0^1 (\varepsilon_{t,i})^\alpha di \leqq (\int_0^1 \varepsilon_{t,i} di)^\alpha = 1$ (" = " only if $\varepsilon_{t,i} = 1$, for all i). Thus $\ln \int_0^1 (\varepsilon_{t,i})^\alpha di \leqq 0$. Comparing (4.15) with (4.17), the growth rate in the case of closure of the credit market is no larger than that in the case of a perfect credit market. Only for the situation of completely equal society in terms of initial capital distribution, is the growth rate in these two cases the same. Furthermore, greater inequality between $\varepsilon_{t,i}$ for a given aggregate $\varepsilon_{t,i}$ will further reduce the aggregate production and the economic growth rate. ■

Proposition 4.3

Proof.

$$\max_{b_{t,i}} \; sp\alpha(w_{t,i}+b_{t,i})^{\alpha}y_{t-1}^{1-\alpha} - pb_{t,i}R_t \tag{4.18}$$

Subject to

$$\text{(IC) } c_{t,i}^{s} \geqq c_{t,i}^{R} \tag{4.19}$$

$$\text{i.e., } sp\alpha(w_{t,i}+b_{t,i})^{\alpha}y_{t-1}^{1-\alpha} - pb_{t,i}R_t \geqq sq\alpha(w_{t,i}+b_{t,i})^{\alpha}(y_{t-1}^{1-\alpha}+\theta) - qb_{t,i}R_t$$

$$\text{(PC) } r_t \leqq pR_t$$

At equilibrium, $r_t = pR_t$. Denote γ_i as the Lagrangian multiplier. The FOC is

$$\begin{aligned} &sp\alpha^2(w_{t,i}+b_{t,i})^{\alpha-1}y_{t-1}^{1-\alpha} - pR_t + \gamma_i[sp\alpha^2(w_{t,i}+b_{t,i})^{\alpha-1}y_{t-1}^{1-\alpha} \\ &-pR_t - sq\alpha^2(w_{t,i}+b_{t,i})^{\alpha-1}(y_{t-1}^{1-\alpha}+\theta) - qR_t] = 0 \end{aligned} \tag{4.20}$$

and

$$\gamma_i \geqq 0,\; c_{t,i}^{s} \geqq c_{t,i}^{R}, and\; \gamma_i(c_{t,i}^{s} - c_{t,i}^{R_t}) = 0$$

(i). By assumption (2), if $b_{t,i} \leq 0$ (the lenders), then constraint (4.4) must be held with strictly inequality. So for these i, $\gamma_i = 0$. Therefore, for these i,

$$sp\alpha^2(w_{t,i}+b_{t,i})^{\alpha-1}y_{t-1}^{1-\alpha} = pR_t$$

Thus,

$$b_{t,i} = y_{t-1}(\frac{s\alpha^2}{R_t})^{\frac{1}{1-\alpha}} - w_{t,i} \tag{4.21}$$

The dividing capital level $\bar{w}_t$ above which households are lenders could be easily calculated as the following. Assign $b_{t,i} = 0$, then

$$w_{t,i} = y_{t-1}(\frac{s\alpha^2}{R_t})^{\frac{1}{1-\alpha}} = \bar{w}_t. \tag{4.22}$$

In sum, households with $w_{t,i} > \bar{w}_t$ are lenders, and have the same investment level

$$k_{t,i} = w_{t,i} + b_{t,i} = y_{t-1}(\frac{s\alpha^2}{R_t})^{\frac{1}{1-\alpha}} = \bar{k}_t$$

(ii). Households with $w_{t,i} < \bar{w}_t$ are borrowers. For these households, it is possible that (IC) binds. Assume that $\hat{b}_{t,i} = b(w_{t,i})$ is the amount of borrowing at which level (IC) binds, i.e. $b(w_{t,i})$ satisfies,

$$sp\alpha(w_{t,i}+b(w_{t,i}))^{\alpha}y_{t-1}^{1-\alpha} - pb(w_{t,i})R_t = sq\alpha(w_{t,i}+b(w_{t,i}))^{\alpha}(y_{t-1}^{1-\alpha}+\theta) - qb(w_{t,i})R_t \tag{4.23}$$

Take the derivative with respect to $w_{t,i}$,

$$\begin{aligned} & sp\alpha^2(w_{t,i}+b(w_{t,i}))^{\alpha-1}y_{t-1}^{1-\alpha}(1+\frac{d\hat{b}}{dw_{t,i}})-pR_t\frac{d\hat{b}}{dw_{t,i}} \\ = \; & sq\alpha^2(w_{t,i}+b(w_{t,i}))^{\alpha-1}(y_{t-1}^{1-\alpha}+\theta)(1+\frac{d\hat{b}}{dw_{t,i}})-qR_t\frac{d\hat{b}}{dw_{t,i}} \end{aligned}$$

i.e.,

$$\begin{aligned} & [sp\alpha^2(w_{t,i}+b(w_{t,i}))^{\alpha-1}y_{t-1}^{1-\alpha}-sq\alpha^2(w_{t,i}+b(w_{t,i}))^{\alpha-1}(y_{t-1}^{1-\alpha}+\theta)]+ \\ & \frac{d\hat{b}}{dw_{t,i}}\{[sp\alpha^2(w_{t,i}+b(w_{t,i}))^{\alpha-1}y_{t-1}^{1-\alpha}-pR_t]-[sq\alpha^2(w_{t,i}+b(w_{t,i}))^{\alpha-1}(y_{t-1}^{1-\alpha}+\theta)-qR_t]\} \\ = \; & 0 \end{aligned}$$

By assumptions (1) and (2), $\frac{d\hat{b}}{dw_{t,i}} > 0$.Furthermore, for a given capital level $w_{t,i}$, if $b_{t,i} > \hat{b}_{t,i} = b(w_{t,i})$, then $c_{t,i}^s < c_{t,i}^R$.(By assumption (2), starting from $\hat{b}$ at which level $c_{t,i}^s = c_{t,i}^R$, an additional unit of increase of b will give rise to a greater increase of expected consumption from the risky project than from the safe project). Without the (IC) constraint, we can get the optimal level of borrowing from the equation $b_{t,i} = y_{t-1}(\frac{s\alpha^2}{R_t})^{\frac{1}{1-\alpha}} - w_{t,i}$. According to this, households with low capital levels desire to borrow more if no incentive constraint is imposed. However, facing the binding (IC) constraint, lower capital households can borrow only at lower levels ($\frac{d\hat{b}}{dw_{t,i}} > 0$). Therefore, there exists a wealth level $\underline{w}_t$, such that

(iia) when $w_{t,i} \geqq \underline{w}_t$, (IC) does not bind and

$$b_{t,i} = y_{t-1}(\frac{s\alpha^2}{R_t})^{\frac{1}{1-\alpha}} - w_{t,i}; \tag{4.24}$$

(iib) when $w_{t,i} < \underline{w}_t$, (IC) binds and

$$b_{t,i} = \hat{b}_{t,i} = b(w_{t,i}) \tag{4.25}$$

The dividing wealth level $\underline{w}_t$ and the corresponding borrowing amount $\underline{b}_t$ have to satisfy two conditions:

First, $\underline{b}_t = y_{t-1}(\frac{s\alpha^2}{R_t})^{\frac{1}{1-\alpha}} - \underline{w}_t$; Second, $\underline{b}_t = b(\underline{w}_t)$. These two equations determine unique $\underline{w}_t$ and $\underline{b}_t$. Substituting $\underline{b}_t + \underline{w}_t = y_{t-1}(\frac{s\alpha^2}{R_t})^{\frac{1}{1-\alpha}}$ into (4.23), we get

$$\underline{b}_t = \frac{(\frac{s\alpha^2}{R})^{\frac{\alpha}{1-\alpha}} s\alpha y_{t-1}[p-q-\theta q y_{t-1}^{1-\alpha}]}{(p-q)R_t}$$

and

$$\underline{w}_t = y_{t-1}(\frac{s\alpha^2}{R_t})^{\frac{1}{1-\alpha}} - \frac{(\frac{s\alpha^2}{R})^{\frac{\alpha}{1-\alpha}} s\alpha y_{t-1}[p-q-\theta q y_{t-1}^{1-\alpha}]}{(p-q)R_t} \tag{4.26}$$

For households $w_{t,i} < \underline{w}_t$, $\gamma_i > 0$. See (4.20); by assumption (2), we get

$$sp\alpha^2(w_{t,i}+b_{t,i})^{\alpha-1}y_{t-1}^{1-\alpha} - pR_t > 0$$

Intuitively, all of the relatively poor households have investment levels smaller than the desired level; thus, the marginal return of investment is greater than the expected cost of borrowing.

In sum,

$w_{t,i} > \bar{w}_t, b_{t,i} = y_{t-1}(\frac{s\alpha^2}{R_t})^{\frac{1}{1-\alpha}} - w_{t,i}$

$w_{t,i} = \bar{w}_t, b_{t,i} = 0$

$\bar{w}_t > w_{t,i} \geqq \underline{w}_t, b_{t,i} = y_{t-1}(\frac{s\alpha^2}{R_t})^{\frac{1}{1-\alpha}} - w_{t,i}$

$\underline{w}_t > w_{t,i} > 0, b_{t,i} = \hat{b} = b(w_{t,i})$

Market clearing condition: $\int_0^{\underline{w}_t} b(w_{t,i})dw + \int_{\underline{w}_t}^{+\infty}[y_{t-1}(\frac{s\alpha^2}{R_t})^{\frac{1}{1-\alpha}} - w_{t,i}]dw = 0$. R_t can be solved by this market clearing condition. ■

Lemma 4.4

Proof. Suppose $\bar{w}_t \leqq (1-\alpha)y_{t-1}$. It is easy to show that using the perfect credit market as comparison reference, the aggregate supply of credit increases, whereas the aggregate demand of credit decreases. This direction of change will violate the market clearing condition. Therefore, it is impossible that $\bar{w}_t \leqq (1-\alpha)y_{t-1}$. The only possibility is that $\bar{w}_t > (1-\alpha)y_{t-1}$.The comparison of interest rate and investment levels between the perfect credit market and imperfect credit market cases can be accomplished easily if we know $\bar{w}_t > (1-\alpha)y_{t-1}$. ■

Lemma 4.5

Proof. $b(w_{t,i};\theta,\frac{p}{q})$ is defined by (4.23). By assumptions (1) and (2), it is easy to prove that $\frac{\partial b(w_{t,i};\theta,\frac{p}{q})}{\partial\theta} < 0$ and $\frac{\partial b(w_{t,i};\theta,\frac{p}{q})}{\partial(\frac{p}{q})} > 0$. Then, we can easily prove how $\bar{w}_t$ and $\underline{w}_t$ change with θ and $\frac{p}{q}$.

See (4.26). When $\theta \to \infty$ or $\frac{p}{q} \to 1$, $\underline{w}_t \to \infty$. There is no credit activity in the economy. At the other extreme, when $\theta \to 0$ or $\frac{p}{q} \to \infty$, $\underline{w}_t \to (1-\frac{1}{\alpha})y_{t-1}(\frac{s\alpha^2}{R_t})^{\frac{1}{1-\alpha}} < 0$. Nobody gets financially constrained and we return to the perfect credit market situation. ■

Proposition 4.6

Proof. (i). For lenders, the problem is

$$\max_{b_{t,i}} \; sp\alpha(w_{t,i}+b_{t,i})^{\alpha}y_{t-1}^{1-\alpha} - r_t b_{t,i} \tag{4.27}$$

The FOC gives rise to

$$b_{t,i} = y_{t-1}(\frac{sp\alpha^2}{r_t})^{\frac{1}{1-\alpha}} - w_{t,i} = y_{t-1}(\frac{s\alpha^2}{R_t})^{\frac{1}{1-\alpha}} - w_{t,i} \tag{4.28}$$

Here, $R_t p = r_t$. When $w_{t,i} > \check{w}_t = y_{t-1}(\frac{s\alpha^2}{R_t})^{\frac{1}{1-\alpha}}$, $b_{t,i} < 0$. These households are lenders.

(ii). For borrowers, the problem is

$$\max_{b_{t,i}} \; sp\alpha(w_{t,i} + b_{t,i})^{\alpha} y_{t-1}^{1-\alpha} - pb_{t,i}R_t' \tag{4.29}$$

There is no incentive constraint for borrowers because of the perfect monitoring ability of the informal credit market. Substitute

$$R_t' = \frac{\pi + r_t}{p} \tag{4.30}$$

into the problem. The FOC leads to

$$b_{t,i} = y_{t-1}(\frac{s\alpha^2 p}{\pi + r_t})^{\frac{1}{1-\alpha}} - w_{t,i} = y_{t-1}(\frac{s\alpha^2 p}{\pi + R_t p})^{\frac{1}{1-\alpha}} - w_{t,i} \tag{4.31}$$

When $w_{t,i} < \hat{w}_t = y_{t-1}(\frac{s\alpha^2 p}{\pi + R_t p})^{\frac{1}{1-\alpha}}$, $b_{t,i} > 0$. These households are borrowers. Since $y_{t-1}(\frac{s\alpha^2}{R_t})^{\frac{1}{1-\alpha}} > y_{t-1}(\frac{s\alpha^2 p}{\pi + pR_t})^{\frac{1}{1-\alpha}}$, the borrowers' investment level is smaller than that of the lenders.

(iii). Households with capital levels such that $\check{w}_t \geqq w_{t,i} \geqq \hat{w}_t$ are neither borrowers nor lenders. They invest all of their capital and will certainly choose the safe project, due to assumption (1).

Market clearing condition: $\int_0^{\hat{w}_t}[y_{t-1}(\frac{s\alpha^2 p}{\pi + pR_t})^{\frac{1}{1-\alpha}} - w_{t,i}]dw + \int_{\check{w}_t}^{+\infty}[y_{t-1}(\frac{s\alpha^2}{R_t})^{\frac{1}{1-\alpha}} - w_{t,i}]dw = 0$. ■

Lemma 4.7

Proof. We only need to prove that $y_{t-1}(\frac{s\alpha^2 p}{\pi + pR_t})^{\frac{1}{1-\alpha}} < (1-\alpha)y_{t-1} < y_{t-1}(\frac{s\alpha^2}{R_t})^{\frac{1}{1-\alpha}}$. If not, for example, if $(1-\alpha)y_{t-1} \geqq y_{t-1}(\frac{s\alpha^2}{R_t})^{\frac{1}{1-\alpha}}$, it is easy to show that using the perfect credit market as reference, the aggregate supply of credit increases, whereas the aggregate demand of credit decreases. This direction of change will violate the market clearing condition. It is therefore impossible that $(1-\alpha)y_{t-1} \geqq y_{t-1}(\frac{s\alpha^2}{R_t})^{\frac{1}{1-\alpha}}$.

The comparison of interest rate levels and investment levels between the perfect credit market and imperfect credit market cases can be easily accomplished if we know $y_{t-1}(\frac{s\alpha^2 p}{\pi + pR_t})^{\frac{1}{1-\alpha}} < (1-\alpha)y_{t-1} < y_{t-1}(\frac{s\alpha^2}{R_t})^{\frac{1}{1-\alpha}}$. ■

Lemma 4.8

Proof. When π goes to zero, we return to the perfect credit market case;

When π goes to infinity, we see that there will be no demand for borrowing (see 4.31, when $\pi \to \infty$, $b_{t,i} = -w_{t,i} \leq 0$). There will thus be no credit supply. This corresponds to the case of closing down the credit market. ■

Proposition 4.9

Proof. See (4.21), (4.24), (4.25), (4.28) and (4.31), We get the optimal amount of borrowing or lending from the expected consumption maximization problem as a function of the initial capital. Plugging these expressions to $c^s_{t,i}$, we obtain "value functions".

(i). In the formal credit market, the value functions of different capital levels are as following:

$w_{t,i} \in [\bar{w}_t = y_{t-1}(\frac{s\alpha^2}{R_t})^{\frac{1}{1-\alpha}}, \infty)$, $c^s_{t,i}(w_{t,i}) = sp\alpha y_{t-1}(\frac{s\alpha^2}{R_t})^{\frac{\alpha}{1-\alpha}} - pR_t y_{t-1}(\frac{s\alpha^2}{R_t})^{\frac{1}{1-\alpha}} + pR_t w_{t,i}$

$w_{t,i} \in [\underline{w}_t, y_{t-1}(\frac{s\alpha^2}{R_t})^{\frac{1}{1-\alpha}})$, $c^s_{t,i}(w_{t,i}) = sp\alpha y_{t-1}(\frac{s\alpha^2}{R_t})^{\frac{\alpha}{1-\alpha}} - pR_t y_{t-1}(\frac{s\alpha^2}{R_t})^{\frac{1}{1-\alpha}} + pR_t w_{t,i}$

$w_{t,i} \in [0, \underline{w}_t)$, $c^s_{t,i}(w_{t,i}) = sp\alpha(w_{t,i} + b(w_{t,i}))^\alpha y_{t-1}^{1-\alpha} - pb(w_{t,i})R_t$

Therefore, the slopes of these value functions are

$w_{t,i} \in [\underline{w}_t, \infty)$, $\frac{\partial c^s_{t,i}(w_{t,i})}{\partial w_{t,i}} = pR_t$ (we can obtain the same result by using the envelope theorem).

$w_{t,i} \in [0, \underline{w}_t)$, $\frac{\partial c^s_{t,i}(w_{t,i})}{\partial w_{t,i}} = sp\alpha^2(w_{t,i} + b(w_{t,i}))^{\alpha-1}(y_{t-1})^{1-\alpha} + \frac{\partial b(w_{t,i})}{\partial w_{t,i}}[sp\alpha^2(w_{t,i} + b(w_{t,i}))^{\alpha-1}(y_{t-1})^{1-\alpha} - R_t p]$

(ii). In the informal credit market, the value functions of different capital levels are as the following:

$w_{t,i} \in [\check{w} = y_{t-1}(\frac{s\alpha^2}{R_t})^{\frac{1}{1-\alpha}}, \infty)$, $c^s_{t,i}(w_{t,i}) = sp\alpha y_{t-1}(\frac{s\alpha^2}{R_t})^{\frac{\alpha}{1-\alpha}} - pR_t y_{t-1}(\frac{s\alpha^2}{R_t})^{\frac{1}{1-\alpha}} + pR_t w_{t,i}$

$w_{t,i} \in [y_{t-1}(\frac{s\alpha^2 p}{\pi + pR_t})^{\frac{1}{1-\alpha}}, y_{t-1}(\frac{s\alpha^2}{R_t})^{\frac{1}{1-\alpha}})$, $c^s_{t,i}(w_{t,i}) = sp\alpha w_{t,i}^\alpha y_{t-1}^{1-\alpha}$

$w_{t,i} \in [0, y_{t-1}(\frac{s\alpha^2 p}{\pi + pR_t})^{\frac{1}{1-\alpha}} = \hat{w})$, $c^s_{t,i}(w_{t,i}) = sp\alpha y_{t-1}(\frac{s\alpha^2 p}{\pi + R_t p})^{\frac{\alpha}{1-\alpha}} - (\pi + pR_t)y_{t-1}(\frac{s\alpha^2 p}{\pi + R_t p})^{\frac{1}{1-\alpha}} + (\pi + pR_t)w_{t,i}$

Therefore, the slopes of these value functions are

$w_{t,i} \in [y_{t-1}(\frac{s\alpha^2}{R_t})^{\frac{1}{1-\alpha}}, \infty)$, $\frac{\partial c^s_{t,i}(w_{t,i})}{\partial w_{t,i}} = pR_t$

$w_{t,i} \in [y_{t-1}(\frac{s\alpha^2 p}{\pi + pR_t})^{\frac{1}{1-\alpha}}, y_{t-1}(\frac{s\alpha^2}{R_t})^{\frac{1}{1-\alpha}})$, $\frac{\partial c^s_{t,i}(w_{t,i})}{\partial w_{t,i}} = sp\alpha^2 w_{t,i}^{\alpha-1} y_{t-1}^{1-\alpha}$

$w_{t,i} \in [0, y_{t-1}(\frac{s\alpha^2 p}{\pi + pR_t})^{\frac{1}{1-\alpha}})$, $\frac{\partial c^s_{t,i}(k_{t,i})}{\partial k_{t,i}} = \pi + pR_t$

(iii). Compare these two cases.

Importantly, no arbitrary condition stipulates that R_t is the same in two markets. Then, $\bar{w}_t$ of the formal credit market case will be the same as $\check{w}_t$ of the informal credit market case. By (i) and (ii) we can thus easily compare

the levels and the slopes of the value functions of these two cases at different levels of capital. Figure 4.4.1 shows these two value lines.

(iv). To prove the existence of $\tilde{w}_t$ we proceed as follows.

For the value line of the formal credit market, we calculate out the levels and slopes of two special points:

When $w_{t,i} = 0$, $c^s_{t,i}(0) = 0$ and $\frac{\partial c^s_{t,i}(w_{t,i})}{\partial w_{t,i}} \mid_{w_{t,i}=0} \rightarrow \infty$;

When $w_{t,i} = \hat{w}$, it is easy to prove that for a sufficiently small θ, or large $\frac{p}{q}$ or large y_{t-i} or small π, $\hat{w} > \underline{w}_t$ (compare (4.26) with $y_{t-1}(\frac{s\alpha^2 p}{\pi + pR_t})^{\frac{1}{1-\alpha}}$).Therefore,

$$c^s_{t,i}(\hat{w}) = sp\alpha y_{t-1}(\frac{s\alpha^2}{R_t})^{\frac{\alpha}{1-\alpha}} - pR_t y_{t-1}(\frac{s\alpha^2}{R_t})^{\frac{1}{1-\alpha}} + pR_t y_{t-1}(\frac{s\alpha^2 p}{\pi + pR_t})^{\frac{1}{1-\alpha}} \quad (4.32)$$

For the value line of the informal credit market:

When $w_{t,i} = 0$, $c^s_{t,i}(0) = y_{t-1}[sp\alpha(\frac{s\alpha^2 p}{\pi + R_t p})^{\frac{\alpha}{1-\alpha}} - (\pi + pR_t)(\frac{s\alpha^2 p}{\pi + R_t p})^{\frac{1}{1-\alpha}}] > 0$ and $\frac{\partial c^s_{t,i}(w_{t,i})}{\partial w_{t,i}} \mid_{w_{t,i}=0} = \pi + pR_t < \infty$;

When $w_{t,i} = \hat{w}$,

$$c^s_{t,i}(\hat{w}) = sp\alpha y_{t-1}(\frac{s\alpha^2 p}{\pi + R_t p})^{\frac{\alpha}{1-\alpha}} \quad (4.33)$$

We can prove that when $\pi > 0, (4.32) > (4.33)$.

Therefore, there exists $\tilde{w}_t < \hat{w}$, at which these two value lines cross each other. ■

Lemma 4.10

Proof. Since the aggregate demand of credit increases when the informal credit market exists, the threshold capital level above which households are lenders ($\bar{w}$) must move to the left to increase the aggregate supply of credit. More households thus become lenders, and the former lenders in the situation of the mere existence of formal credit market lend more. Since the investment level of lenders is therefore reduced, the interest rate will be higher in the coexistence situation than that in mere formal credit market situation. It is also very easy to prove the relationship between π and the size of the households remaining financially constraint in the coexistence situation. ■

4B Figures

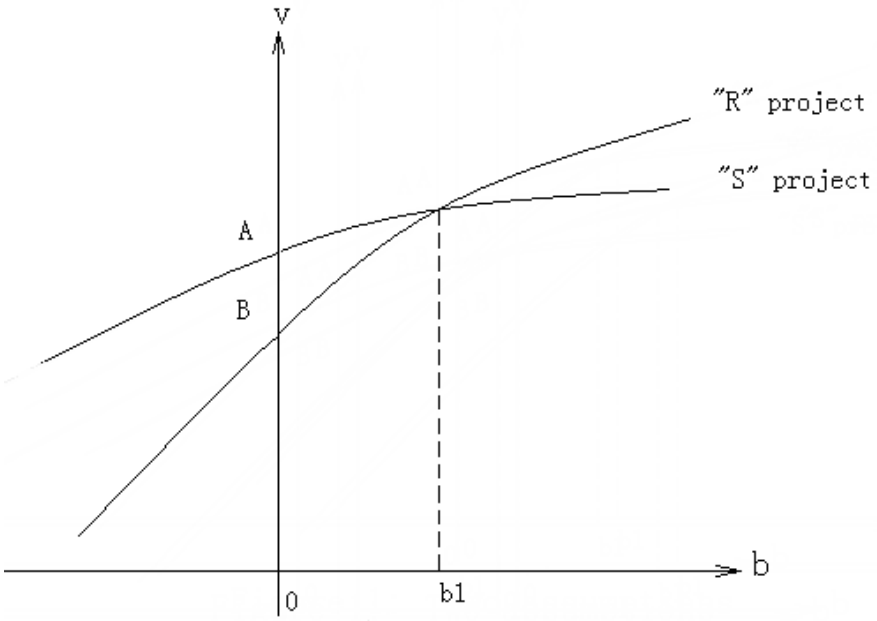

Figure 4.1: Two Assumptions

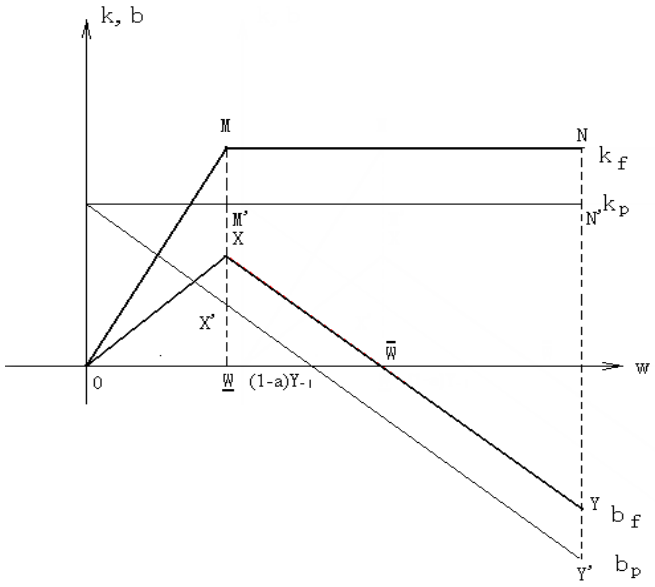

Figure 4.2: "Perfect" vs. "Formal"

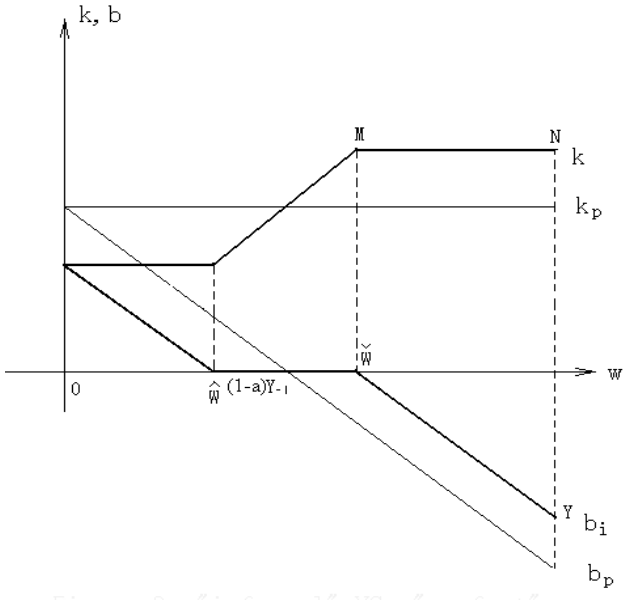

Figure 4.3: "Informal" vs. "Perfect"

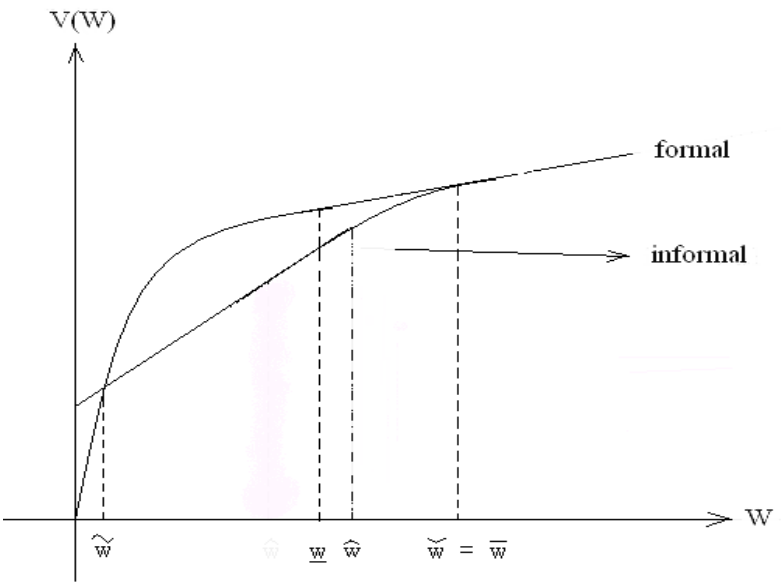

Figure 4.4.1: Coexistence – value comparions

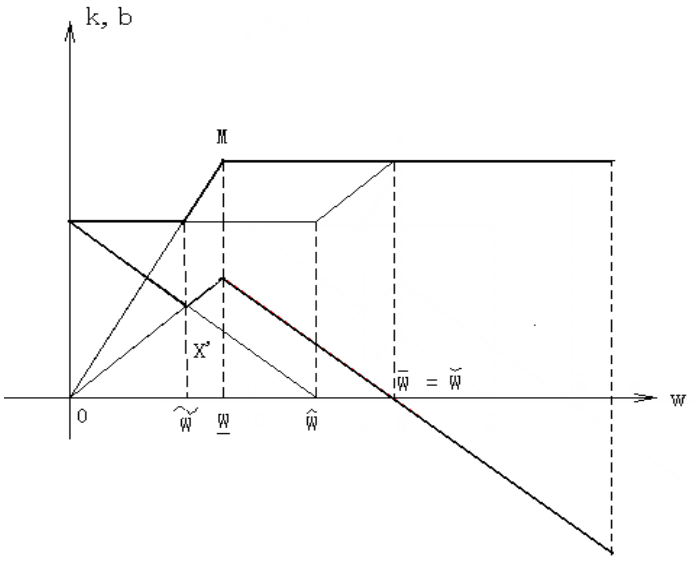

Figure 4.4.2: Coexistence – equilibrium

4C Tables

Table 4.1: Data Description

Variables	Obs.	Minimum	Maximum	Mean	Std.Deviation
ANNUGROW	29	0.0106	0.0720	0.0484	0.0154
GINI88	29	0.2010	0.3250	0.2640	0.0362
INVEST	29	0.3025	0.4455	0.3872	0.0412
LABGROW	29	-0.0218	0.0287	0.0102	0.0129
EDUCA88	29	4.2632	8.2912	6.4795	0.9418
LNFIXCAP	29	5.7902	8.0942	6.8238	0.5711
EMPLOY88	29	0.0912	0.6300	0.2517	0.1349
LNPOPU88	29	5.6795	9.1203	7.6078	1.0261
DUMMY	29	0.0000	1.0000	0.3679	0.4234

Table 4.2: Basic Model

Variables	Coefficients	Std.Error	t-value
Constant	0.005	0.028	0.186
GINI88	-0.149	0.063	-2.349
INVEST	0.094	0.044	2.136
LABGROW	0.567	0.248	2.286
EDUCA88	0.012	0.004	3.002

F=5.332 P-value=0.002 R_t^2=0.459

Table 4.3: Full Model

Variables	Coefficient	Std.Error	t-value
Constant	-0.221	0.077	2.870
GINI88	-0.173	0.076	2.276
INVEST	0.081	0.040	2.025
LABGROW	0.312	0.183	1.705
EDUCA88	0.007	0.003	2.290
LNFIXCAP	0.018	0.010	1.800
EMPLOY88	0.053	0.042	1.262
LNPOPU88	0.012	0.005	2.400
DUMMY	0.015	0.009	1.667

$F = 6.700$ Significancy $= 0.001$ $R_t^2 = 0.802$

Table 4.4: Sensitivity Analysis on the Focus Coefficient of GINI88

	$\delta = 1.0$	$\delta = 0.1$	$\delta = 0.4$	$\delta = 0.0$
Upper	-0.024	-0.087	-0.124	-0.173
Lower	-0.313	-0.285	-0.203	-0.173

Chapter 5

The Political Economy of Interest Rate Liberalization and a Chinese Case Study (1980-2004)

5.1 Introduction

This chapter studies the determination of interest rates (deposit and loan interest rates) – not as the demand-supply equilibrium by the decentralized market mechanism, but as the outcome of a political economy process in which the regulator makes centralized choices to maximize its objective function, taking various political economy factors into consideration. Although since the late 1980s many countries(both developed and developing) have started to liberalize interest rates, some countries still have interest rates regulated – sometimes to a significant extent – by the government. Academics have long been interested in explaining the unwillingness or delay of the government in giving up its intervention in interest rates. The existing literature has already provided several *normative* justifications for interest rate controls. "Mild financial repression" policies (Bencivenga and Smith, 1992), for example, may imply controlled interest rates, serving as tax instruments for the purpose of optimizing the overall tax structure. "Financial restraint" policies (Hellmanna, Murdock and Stiglitz, 1997) attempt to create more rents for banks to further mobilize national savings, and "developmental state" policies use controlled interest rates to support specific industries, etc. This chapter applies a political economy approach in an attempt to provide, both theoretically and empirically, a *positive* interpreta-

tion of the control of interest rates and their deviations from the domestic market–clearing rates (when the economy is closed) or from the international rate (when the economy is open).

In theory, in the absence of any political distortions and normative economic considerations, the regulator's social welfare maximization problem will lead to interest-rate choices that mimic the competitive market results. However, when the regulator has a particular bias towards certain sectors, or when some agents in the economy are able to overcome the free-rider problem to lobby regulators, then the regulator's maximization problem may lead to interest-rate choices that are different from competitive results and induce deadweight loss. Over time, the political forces (such as the relative size of lobby vs. non lobbying groups) and the new institutional surroundings (such as the possibility of access to the international financial market) will result in dynamic changes of the extent of the deviations from market competitive results. Since interest-rate liberalization means that market forces mainly determine interest rates, market results will thus emerge; agents will favor or oppose interest-rate liberalization depending on whether they were disfavored or favored in the previous political economy equilibrium. To capture these ideas, this chapter builds up a lobbying-for-interest-rate model with ideological bias, in both a closed and an open economic setting.

Over the past two decades, China's transformation into a dynamic private-sector-led market economy and its rapid integration with the world economy (through both trade and financial linkages) have proven landmark events in global economic history. Economists worldwide have tried to understand the logic of China's reform path and its not yet solved puzzles. One phenomenon that has yet to receive adequate attention is the fact that the market-oriented reform of the financial system in China has lagged far behind the other aspects of the reform. By 1999, the degree of marketization[1] of the financial system was only 15%, whereas the degree of maketization of the Chinese economy as a whole was 50% (Hu and Wu, 2002); by 2000, more than 90% of the commodity prices in China were determined by free market forces, rather than a central plan (Hu and Wu, 2002). Interest rates were still under direct control, however. In October 1992, China officially set the ultimate goal of its reform as "socialist market economy". Although many economists since then have started to advocate interest-rate liberalization in China, interest-rate liberalization remained in its infancy until the year 2000. Only quite recently, thus has China accelerated the pace of interest-rate liberalization.

[1] Hu and Wu measure the extent of marketization from 9 aspects with 24 specific indicators, including the extent of government ownership, market entry restrictions, the degree of government intervention on prices, the development of market intermediary organizations, the mobility of labor, and the rule of law, etc.

Although one can try to justify interest-rate control in China by relying on various normative reasons, the relevance and soundness of these reasons remain questionable. For example, Shuai (2001) applies the "financial restraint" argument to justify interest-rate control in China, regarding the controlled interest rate as a way to transfer rents to Chinese banks to deepen the Chinese financial system. He overlooks, however, the fact that the "financial restraint" (Hellmanna, Murdock and Stiglitz, 1997) theory assumes that banks are privately owned and have independent incentives. Banks could therefore put more effort into deepening the financial system when more rents could be obtained. Most Chinese banks are state-owned, however, and do not have independent incentives. Rents, if created, are retained by the public sector, rather than going to the private sector. Finally, the "financial restraint" policy requires a positive real interest-rate and a reasonable size of the interest rate spread, neither of which existed in China.

In the case study part of the chapter, we try to answer why China actually controls its interest rate (rather than pondering why China should or should not control it). In other words, we attempt to find a positive, rather than a normative explanation for China's continuing interest-rate control. This alternative perspective in understanding the maintenance of interest-rate control can also be extended to explain the recent tendency of liberalizing interest rates. We believe the far-lagged interest-rate liberalization (compared with the great extent of marketization of most other aspects of economy in China) offers a particularly nice case for testing the political economy model of interest-rate determination that we have constructed.

This chapter is organized as follows. Section 5.2 conducts a literature review to facilitate an understanding of the political economic reasons behind financial regulations and deregulation. We also review the literature on the debates on interest-rate liberalization. Section 5.3 constructs the theoretical political economy model. Section 5.4 focuses on the Chinese case over the period 1980 to 2004. Section 5.5 concludes.

5.2 Literature review

The chapter's study of interest-rate liberalization in a political economy framework basically combines the traditional literature on financial liberalization with the newly emerging literature on political economy of finance and financial (de)regulation.

5.2.1 Interest-rate liberalization debate

Financial deepening theorists (McKinnon, 1973; and Shaw, 1973) have advocated financial liberalization for some time. Their key argument: compared to financial repression[2] (in which situation interest rates are normally regulated and set below the market equilibrium level), interest rates determined by the free market have positive effects on economic growth. This follows from the resulting increase of investment efficiency[3], the further mobilized savings increasing the level of investment, and the enhancement of competition among intermediaries increasing the efficiency of financial intermediaries. Cumulative evidence supports the orthodox theoretical argument. Fry (1980) shows that, in Asian countries, a 1% increase of the real interest rate towards the equilibrium-level rate would cause economic growth to increase by 0.5%. Lanyi and Saracoglu (1983) conducted an econometric analysis of 21 developing countries in the period of 1971—1980, and found that the real interest rate is positively correlated with financial asset increase and GDP growth. In order to avoid the shortcomings of omitted variables, Roubini and Sala-I-Martin (1992) applied the multiple variables method and found the growth-enhancing impacts of financial liberalization: on average, countries with an interest rate 5% below average exhibit a growth rate 1.4% lower than countries with positive interest rates. As to the relative importance of channels through which interest-rate liberalization could lead to a high economic growth, Gelb (1989) finds that most of the positive association between real interest rates and growth stems from the investment efficiency effect rather than the level of investment.

In recent years, however, the contrasting experiences of the newly industrializing East Asian economies with Latin America suggest that government intervention in financial markets could be welfare enhancing. Theoretical debate on interest rate liberalization began in earnest at the beginning of 1990s[4]. The critics of the McKinnon-Shaw paradigm emphasize the possibility of financial market failures, arguing for some degree of interest rate

[2]Financially repressed system can be characterized as one in which the government determines who gets and gives credit and at what price. A government can exercise or reinforce such control by regulating which financial institutions will be permitted to do business and how they will be permitted to operate, by owning banks and other financial intermediaries, and by exercising control over international capital movements. Financial liberalization points out to opposite direction regarding to all of these dimensions.

[3]The reason is the following. The low interest rate will make low-yielding projects profitable, and therefore, given a degree of randomness in bank lending decisions, there will be many low-yielding investments that will serve to reduce the average rate of return on investment.

[4]See Blommestein, H. and J. Lange (eds.) (1993).

control to be maintained over the financial sector – at least over a foreseeable period of time. More specifically, the rethinking and the move toward a more cautious approach to interest-rate liberalization are based on several considerations.

First, McKinnon (1993) himself raises the theory of the order of economic liberalization, which maintains that countries should liberalize interest rates and the flow of credit only after macroeconomic stability has been established, real reforms have been implemented, and a system of supervision has been put in place. Caprio (1995) further argues that interest rates should be liberalized only when banks have positive net worth, bank managers have attained adequate sophistication in terms of their ability to judge credit risks, and financial markets are contestable. For particular focus on transition countries' necessity of bank restructuring before liberalization, see, for example, Blommestein, H. and M. Spencer (1994), Not many countries, however, have actually followed such counsel.

Second, the theory of adverse selection and moral hazard has cast new light on interest-rate liberalization (Stiglitz and Weiss, 1981). When asymmetric information exists between borrowers and lenders, a higher interest rate could lead to a more severe adverse selection and moral hazard problem, thus increasing the risks of a bank's portfolio. Since interest-rate liberalization is frequently accompanied by higher interest rates, this theory attaches some cautions to interest-rate liberalization. However, the establishment of a well functioning supervision system, together with a higher screening and monitoring ability of banks, could reduce the asymmetric information problem to an acceptably low level.

Third, the recent "financial restraint theory" (Hellmanna, Murdock and Stiglitz, 1997) argues that a deposit interest rate set below the competitive equilibrium level could create "rent opportunities" and "franchise value" to banks, offering incentives for banks to actively mobilize savings, thus deepening the financial system. When "financial constraint" passes on some rents to the production sector through lending rate control, the increase of firms' equity could also reduce the firms' incentive to undertake risky activities. According to these authors, however, "financial restraint" is not a static policy instrument. As the economy matures, and in particular, as the capital base of the financial sector strengthens, "financial restraint" policy can be progressively relaxed and the economy may transit to a more classic "free market" paradigm.

Fourth, an argument has been advanced for "mild financial repression", which applies to countries where widespread income-tax evasion and an underdeveloped debt market make it rational to resort to an inflation tax to help finance the budget deficit (Bencivenga and Smith, 1992). A lower con-

trolled interest rate reduces the cost of government borrowing, which yields greater benefits when the need for government spending is high and the possibilities of raising tax revenue are limited. Giovannini and De Melo (1993) also study financial repression chosen by a government following optimal tax policies. The tax benefit must, however, be weighted with the normal cost of financial repression.

To summarize: because the above arguments have their limitations, and the benefits of interest rate liberalization are widely recognized (although interest-rate liberalization has begun to take a more cautious approach since the 1990s), liberalized and market-determined interest rates are still a widely accepted concept among economists and policy-makers.

5.2.2 Public vs. private interest view of interest-rate regulation

Clearly, the choice of whether to have financial liberalization goes beyond a purely academic debate, and is also a significant policy choice. For analyzing economic policy choices, economists have broadly taken two views: "the public interest view" and "the private interest view" (see Kroszner and Strahan (2001) for a more detailed discussion). According to "the public interest view", the regulator is supposed to play the role of "benevolent social planner". The four justifications listed above for interest-rate regulation, for example, are for the sake of the best economic interests of the public at large.

All financial intervention has significant distributional consequences, however. Existing individual country studies show the distributive effects of interest-rate liberalization. Siregar (1992) finds that in Indonesia, after financial liberalization, credit tended to decrease for both small and large firms, whereas it increased for medium-size firms, verifying that prior to reform, small firms had some special access to credit and most credit subsidies went to large firms with political connections. For Korea, Atiyas (1992) found that small firms gained improved access to external finance after liberalization, and that credit flows also moved from light industrial manufacturing to services, utilities, and construction. For exchange-rate intervention, Huizinga (1996) provides interesting evidence that some countries have used their controlled system of two-tiered exchange rates, with separate commercial and financial exchange rates, to effectively subsidize capital inflows, or national borrowing, from abroad.

The significant distributive effects of financial liberalization thus provide the parties affected by financial regulation with an incentive to try to ensure that the government intervenes in such a way as to benefit them. The

intervention can thus be regarded as one of interest group competition in which compact, well organized groups are able to use the coercive power of the state to capture rents for those groups at the expense of more dispersed groups (Becker, 1983). According to "the private interest view", the public interest argument is often, in fact, used to mask the private interests that the intervention serves. Contrarily, private interests may try to confuse the public debate by providing false or misleading information to make it difficult to discern whether policy would improve social welfare (Kane, 1996).

The political economy approach of financial regulation (taking the "private interest view"), attempts to offer a positive analysis of how and why financial regulation has evolved and what forces can lead to its durability and potential for changes. The approach demonstrates that the banking and financial system is not independent of politics, and describes what implications this interdependence has for understanding reform.

Generally speaking, although political economy tools have long since been applied to the field of economics, only recently have such tools been applied to topics in the field of finance. Pagano and Volpin (2001) conducted a comprehensive review of the emerging literature of the political economy of finance. Kroszner and Strahan (1999) provided an insightful empirical analysis of the political economy of banking regulation in the United States. The authors show that the timing of the deregulation of branch banking across the United States was determined by the relative strengths of the interest groups affected by the reform. Rajan and Zingales (2001) attribute the "great reversal" of the development of the arm's length financial markets of civil-law countries to incumbents' opposition to the development of the external financial market. Incumbents can finance investment opportunities mainly with retained earnings, while potential competitors need external capital to start up: equity market development thus breeds competition for incumbents. Laeven (2004) used a political economy framework to empirically explain the differences in the support for explicit deposit insurance across countries. Montinola and Moreno (2001) applied a lobbying model to show that liberalization of foreign bank entry may result from political changes and a fall in domestic bank efficiency caused by the lack of competition, which raises the costs to domestic banks of restricting foreign bank entry. The Philippines' liberalization of foreign bank entry in 1994 was taken as a case study. A political economy approach has also been applied to other topics of finance, such as exchange rates (Huizinga, 1997; and Broz and Frieden, 2001) and capital control (Alesina, et al., 1993), among others. To our best knowledge, this chapter is the first to apply a political economy approach, together with a country case study to the area of interest-rate liberalization.

5.2.3 A closer review

For the purpose of this study, three strands of research are particularly worth reviewing.

A common agency model was pioneered by Bernheim and Whinston (1986), and applied to trade policy by Grossman and Helpman (1994) and to the structure of the taxation by Dixit et al. (1997). The government is the agent that sets economic policy. Various interest groups act as principals, and confront the government with contribution schedules: with functions mapping economic policy into actions valued by the government. Then, a two-stage game is played. First, the lobbies simultaneously commit to contribution schedules; next, the government, having observed these schedules, sets economic policy. This chapter applies this specific modeling technique.

"Ideology theory" (Kroszner, 1999) emphasizes the beliefs and "ideology" of the politicians in explaining intervention and regulation. Political ideologies are defined as "consistent sets of normative statements as to best or preferred states of the world, which statements are moralistic and altruistic in the sense that they are held as applicable to everyone, rather than merely to the actor making the statements" (Kalt and Zupan, 1984). Within the legislative framework of the United States, several studies (Kalt and Zupan, 1984; Kau and Rubin, 1981) have attempted to explain the voting records of particular congressmen as functions of a relevant economic interest variable plus some measures of the "ideological" orientation of the congressmen. They find that "ideology" is indeed one of the dominant explanatory factors in congressional voting behavior. For post-Communist economies of Eastern Europe and the former Soviet Union countries, Denizer et al. (1998) find that the overall financial repression[5] is greater in countries with a higher percentage of communists in parliament and less party fractionalization. Through a combination of partial state ownership of financial institutions and interest-rate controls, state-owned industries in these countries have been assured a continuous flow of cheap credit. Following this line of literature, this chapter will incorporate the ideology factor into the analyses (demonstrating its necessity for countries like China – with its communist legacy).

Finally there is a growing literature on China. Several studies are close to this study. Aziz and Duenwald (2002) check the "finance-growth nexus" with China's provincial data. They found that there existed an allocation inefficiency of loans across provinces in China: during 1988-1997, those provinces with above-average GDP growth had bank loan-to-GDP ratios that were sta-

[5] In their chapter, the higher the percentage of directed credit to total credit, the lower the central bank real discount rate, the lower the level of financial intermediation, the more the system is depressed.

tistically significantly lower – by up to 36% of GDP at the average – than those of below-average-growth provinces. Bank loans in China thus appear to have been channeled to provinces with a heavy concentration of SOEs, which also have tended to grow relatively slowly. Due to this regional allocative bias toward state-owned enterprises, one can not significantly explain cross-provincial growth differentials in cross-provincial panel regressions with the bank-to-GDP ratio, even after controlling for other variables. Instead, researchers find that the higher loans to the non-state sector can account for a higher provincial growth (significant at the 1% level). This chapter shows the importance of channeling a higher proportion of savings to the non-state sector, which will allow China's financial sector to play the role of efficient intermediary between savers and borrowers, and thus strengthen the positive link between financial development and growth. Brandt and Zhu (2000) explain the co-movement of the growth and inflation in China during reform to the centralization and decentralization of credit allocation shifts. Decentralized credit allocation leads to more credit being allocated to the higher productivity non-state sector, thus resulting in a higher economic growth rate. But at the same time it increases the pressure to subsidize state-owned enterprises. Thus, inflationary financing is relied upon and credit allocation is centralized, which in turn reduces the growth rate (since the non-state sector gets less credit). Using provincial-level data on FDI and trade flows in China over the years 1984-1995, Branstetter and Feenstra (1999) find that the weight applied to consumer welfare is between one-fifth and one-twelfth of the weight applied to the output of state owned enterprises in the government objective function. Government preferences have shifted over time, but even in recent periods the weight on consumer welfare has only been one-half of the weight on state-owned enterprises. Other papers trying to apply a political economic approach to China's overall transition problem (Qian, 1999), to the dual-price system during transition (Lau, et al., 2000) and to Chinese trade policy (Sheng, 2000), have obtained insightful conclusions.

5.3 The model

5.3.1 Set-up

Environment

The economy basically consists of three kinds of players: depositors (D), enterprises and banks (B). Enterprises can be state- or privately owned, denoted as SOEs and PEs, respectively. The nature of ownership affects the weight attached to enterprises in the social welfare function chosen by the

social planner (in this context, the interest rate setter or the "regulator"). In addition, when the economy is open to the international capital market, the fiscal authority or central bank starts to play a role that taxes or subsidizes international capital flows.

The total population is normalized as 1. All individuals supply credit. The total number of depositors is thus 1. Enterprises demand credit and banks intermediate funds. Each individual owns at most one type of enterprise. Assume α^S of the total population owns SOEs and α^P owns PEs. Individuals with enterprise ownership get returns not only from supplying their deposit, but also from the profit of the enterprises. The rest of the population $1-\alpha^S-\alpha^P=\alpha^A$ own no enterprises (supposedly corresponding to people in the agricultural sector (denote superscript "A")), and only get a return by supplying a deposit.

The regulator sets various interest rates, maximizing its objective function.

Behavioral functions

Each depositor supplies credit D according to a credit-supply function

$$D = D(r_D) \tag{5.1}$$

which increases with the deposit interest rate r_D (i.e., $D'(r_D) > 0$). The lower bound of deposit interest rate $\underline{r}$ satisfies $D(\underline{r}) = 0$. Since the total population is 1, the aggregate credit supply is the same as the credit supply per person.

The loan demand functions of SOEs and PEs are different, stemming from their productivity differences. It is well analyzed why PEs on average have higher productivity than SOEs. Shleifer and Vishny (1994) attribute this difference to the possession of the control rights by private firms causing it to be more costly for the government to intervene in a private firm in order to force it to deviate from efficient decisions. Even if the government cares as much about efficiency as firms do, the lack of government commitment to SOEs could still lead to under-capacity production ("Ratchet effects"[6];

[6] "Ratchet effects" refer to a particular phenomenon of socialist economy: the managers of SOEs tends not to fully use their ability leading to under-performance of SOEs. As a government in a socialist economy has monopoly power over managers, it is inevitably tempted to "ratchet up" performance requirements and revise upward incentive schemes for managers with a good performance so as to leave them less rents. The absence of the government commitment power in socialist economy is the main reason account for "rachet effect".

see Roland and Sekkat, 2000) or soft budget constraint-related inefficiency (Dewatripont and Maskin, 1995).

Suppose, for example, that PEs have a greater productivity in comparison with SOEs not only on average, but also at the margin. As far as capital input is concerned (at the same level of capital input), the PEs' marginal productivity can be supposed higher than that of the SOEs'. Since the loan-demand function is the locus of the marginal productivity of capital (which is equal to the interest rate in equilibrium), we can also see that: for a given loan interest rate, the PEs' demand for loans is higher than that of the SOEs. This is true if the SOEs' loan-demand function per person is

$$L^S = L(r_L) \tag{5.2}$$

with $L'(r_L^s) < 0$,and the loan-demand function of PEs per person is assumed to be proportionately higher,

$$L^P = \theta L(r_L) \tag{5.3}$$

with $\theta > 1$ (which is exogenously given). The upper bound of loan interest rates $\bar{r}$ satisfies $L(\bar{r}) = 0$. We assume $\underline{r}<\bar{r}$ to ensure that credit supply and demand lines can cross each other. Correspondingly, the aggregate loan demands of SOEs and PEs are $\alpha^S L^S$ and $\alpha^P L^P$, respectively.

Banks channel credit between depositors and enterprises. The interest-rate spread is their profit margin. Banks could have different profit rates when granting credit to different types of enterprises. Throughout the analyses, we assume that banks act passively – in the sense that they do not actively choose interest rates or quantities to maximize their profit. The interest rates are set by the regulator, and the market-clearing condition thereafter determines quantity.

Surplus, profit and welfare

Since the total population is normalized as one, the aggregate depositors' surplus is the same as the individual's deposit surplus, i.e.,

$$V^D = \int_{\underline{r}}^{r_D} D(s)ds \tag{5.4}$$

which is a function of r_D.

The surplus of aggregate enterprises is

$$V^i = \alpha^i \int_{r_L^i}^{\bar{r}} L^i(s)d(s) \tag{5.5}$$

$i = S, P$,standing for state-owned enterprises and private enterprises, respectively, which represent the surplus of individual enterprises times the population size and are functions of r_L^i.

The total profit of banks is

$$V^B = (r_L^S - r_D)\alpha^S L^S + (r_L^P - r_D)\alpha^P L^P \quad (5.6)$$

which is a function of both deposit- and loan- interest rates.

For populations in different sectors, the aggregate welfare of individuals outside of SOEs or PEs is given by

$$W^A = \alpha^A V^D \quad (5.7)$$

which is an "agricultural" population share of aggregate depositors' surplus.

The aggregate welfare of the individuals possessing SOE or PE ownership is

$$W^S = V^S + \alpha^S V^D \quad (5.8)$$

$$W^P = V^P + \alpha^P V^D \quad (5.9)$$

respectively, which are the sector's surplus plus a corresponding population share of the depositors' surplus.

5.3.2 Regulator's problem in a closed economy

"Closed economy" refers to the situation in which there are no international capital flows and the credit market clears domestically. The regulator sets various interest rates to maximize its objective function. We first study this problem when political distortions and political considerations are absent. Then we add political elements to the model to see how the equilibrium changes.

Socially optimal case

When the regulator's objective function is to maximize social welfare, thus acting as a "benevolent social planner", we obtain the following result.

Proposition 5.1 *When the regulator chooses interest rates to maximize social welfare, defined by* $\Omega = W^D + W^S + W^P + W^B = V^D + V^S + V^P + V^B$, *she sets* $r_D = r_L^S = r_L^P = r^*$. *Here,* r^* *satisfies* $D(r^*) = \alpha^S L^S(r^*) + \alpha^P L^P(r^*) = (\alpha^S + \alpha^P \theta)L(r^*)$.

[7] This is for the case of a closed economy. We will discuss the profit of banks in open economy later.

Proof. *see appendix.* ■

This proposition points out that in the absence of any political distortions, the social-welfare-maximizing regulator will choose interest rates at the same levels as will occur under the competitive market. Thus, the regulator no longer has any reason to regulate the interest rate and can simply let the market work, leading to a socially optimal result. This proposition also verifies that the competitive market equilibrium is social optimal, which is a particular case of the first welfare theorem.

Lemma 5.2 *When the regulator maximizes social welfare, the equilibrium interest rate r^* increases with the productivity parameter θ. The share of credit to SOEs is $\frac{\alpha^S}{\alpha^S+\alpha^P\theta}$ and $\frac{\alpha^P\theta}{\alpha^S+\alpha^P\theta}$ for PEs. PEs get relatively more credit, since they have higher productivity. The higher the productivity advancement of PEs, the more credit they get (relatively). Increasing the share of the population possessing PEs (measured relatively by $\frac{\alpha^P}{\alpha^S}$)also leads to an increased share of aggregate credit granted to PEs.*

Ideological bias and lobbying for interest rates

We add political distortions to the simple model above in two ways. First of all, for certain reasons, the regulator could have a biased attitude towards SOEs. This bias can be modeled by a higher weight associated with the production surplus of SOEs in the regulator's objective function. Define $W_\lambda^S = \lambda V^S + \alpha^S V^D$, where $\lambda > 1$ captures the ideological bias of the regulator towards SOEs. Secondly, we could allow bankers and individuals owning SOEs and PEs to lobby the regulator for setting the interest rate in accordance with their own interests. But individuals in the agricultural sector who do not have any sector ownership cannot lobby at all. This distinction comes from our assumption that sector ownership can serve as a mechanism to overcome free riding and the coordination-failure problem.

Following Grossman and Helpman (1994), we model the lobbying process as a two-stage game. In the first stage, SOEs, PEs and banks simultaneously make contributions to the regulator. One chooses the amount of one's contribution given the contributions made by others and the expected reaction of the government. In the second stage, the regulator sets the interest rates to maximize social welfare plus total contributions. The model's detailed structure is closer to Rama and Tabellini (1997), who model capitalists and a labor union lobbying for an open trade policy and a minimum wage policy at the expense of the unorganized agricultural population. In their model, the interests of capital and labor are aligned over trade policy, but are opposed over labor policy. In our model, the interests of banks and enterprises

are aligned over the deposit interest rate, but opposed over the loan-interest rate. The distinction between SOEs and PEs generates another potential opposing interest among enterprises, due to ideological bias towards SOEs.

The objective function of the regulator is

$$\text{maximize}\, a(W^A+W^S_\lambda+W^P+W^B)+C^S(r_D,r^S_L)+C^P(r_D,r^P_L)+C^B(r_D,r^S_L,r^S_L) \tag{5.10}$$

i.e.

$$\text{maximize}\, a(V^D+\lambda V^S+V^P+V^B)+C^S(r_D,r^S_L)+C^P(r_D,r^P_L)+C^B(r_D,r^S_L,r^S_L) \tag{5.11}$$

Here, a is the weight assigned by the regulator to social welfare. It captures the relative importance of social welfare and total contributions from the regulator's point of view. A higher a indicates that the regulator cares more about social welfare and less about contributions. $C^S(r_D,r^S_L)$, $C^P(r_D,r^P_L)$, and $C^B(r_D,r^S_L,r^S_L)$, the contribution schemes of SOEs, PEs and banks, are the functions of relevant interest rates. The following proposition characterizes the sub-perfect Nash equilibrium of interest rates of this two-stage game.

Proposition 5.3 *When the regulator has a biased attitude towards SOEs, and SOEs, PEs, and banks can make contributions to the regulator to influence the interest-rate choice, a common agency-type two-stage game leads to the following political economy equilibrium:*

$$\frac{r^S_L-r_D}{r_D}=\frac{\frac{\alpha^A}{\varepsilon_D}-\frac{a(\lambda-1)}{\varepsilon^S_L}}{\frac{a(\lambda-1)}{\varepsilon^S_L}+a+1} \tag{5.12}$$

$$\frac{r^P_L-r_D}{r_D}=\frac{\alpha^A}{(a+1)\varepsilon_D} \tag{5.13}$$

Proof. *see appendix.* ■

First, Since $\lambda>1$, so $\frac{r^S_L-r_D}{r_D}<\frac{r^P_L-r_D}{r_D}, i.e. r^S_L<r^P_L$. SOEs face lower loan interest rates than PEs do; SOEs are thus relatively subsidized. The higher the degree of ideological bias towards SOEs and the lower the interest-rate elasticity of loan demand of SOEs, the lower the loan interest rate to SOEs will be, relative to PEs, and the greater the subsidy SOEs get. The relationship between the interest rate elasticity of loan demand of SOEs and the size of the subsidy they get is consistent with the normal Ramsey rule. Moreover, the loan interest rate to PEs will never be less than the deposit

interest rate, whereas the loan interest rate to SOEs could be lower than the deposit interest rate (when λ is very big or when the interest-rate elasticity of loans to SOEs is very small, for example).

Secondly, both interest-rate spreads decrease with the interest-rate elasticity of deposit (ε_D) and increase with α^A. The greater the reactiveness of depositors to the deposit interest rate, and the lower that of the population belonging to the unorganized agricultural sector, the lower the interest-rate spread that will be chosen. Because they cannot act collectively, depositors as a whole have no lobbying influence and can rely merely on increasing their sensitivity of credit supply, indicated by interest-rate elasticity of deposit, to get a higher deposit interest rate and a lower interest-rate spread. Moreover, the lower the proportion of the population in the "agricultural" sector, the more individuals get involved with the lobbying activities, and the higher the extent that the lobbying effects among different lobbying groups are cancelled out, the closer the results will be to the socially optimal solution. At the extreme, when $\alpha^A = 0$ together with $\lambda = 1$, we get $r_D = r_L^S = r_L^P = r^*$.

Thirdly, both interest-rate spreads decrease with a, the weight assigned to social welfare, showing that the less the regulator cares about contributions, the less the interest-rate spread will be. When $a \to \infty$ (the regulator does not care at all about the contribution) together with $\lambda = 1$, both of the interest-rate spreads are zero, arriving at the social optimum.

Some special cases of Proposition 5.3, varied by who participates in the game and whether participants can lobby, are worth further attention, in order of increasing complication.

Case 1: *no PEs exist and neither SOEs nor banks can lobby.*

This is a very simple situation in which the regulator has a biased attitude towards solely existing SOEs, and both SOEs and banks do not lobby. The result of this case corresponds to the outcome of proposition 5.3 by taking $\alpha^P = 0$ and $a \to +\infty$. Then,

$$\frac{r_L^S - r_D}{r_D} = \frac{1-\lambda}{\varepsilon_L^S} \tag{5.14}$$

The loan interest rate to SOEs is always smaller than the deposit rate, and the negative spread results in losses to the banks. The greater the bias and the lower the loan demand elasticity of SOEs, the smaller the loan interest rate will be, compared with the deposit rate. Intuitively, when SOEs enjoy biased support by the regulator, and banks cannot lobby for favored interest-rate settings, banks sacrifice their profit[8] for the subsidy to SOEs stemming from the ideologically biased policy towards SOEs.

[8] Here we focus on one period problem. Overtime, the survival of banks is not a problem

Case 2: *no PEs exist and both SOEs and banks can lobby.*

We get $\frac{r_L^S - r_D}{r_D} = \frac{\frac{\alpha^A}{\varepsilon_D} - \frac{a(\lambda-1)}{\varepsilon_L^S}}{\frac{a(\lambda-1)}{\varepsilon_L^S} + a + 1}$,which is the same as (5.12). Compared with (5.14), where banks cannot lobby, the possibility for banks to lobby increases the weight associated with the banks in the regulator's social-welfare-maximization problem. Therefore, banks do not always get negative returns (when $\frac{\alpha^A}{\varepsilon_D}$is bigger than$\frac{a(\lambda-1)}{\varepsilon_L^S}$, banks get positive returns).

Case 3: *PEs exist but cannot lobby, and only SOEs and banks can lobby.*
We get

$$\frac{r_L^S - r_D}{r_D} = \frac{\frac{\alpha^A + \alpha^P}{\varepsilon_D} - \frac{a(\lambda-1)}{\varepsilon_L^S}}{a + 1 + \frac{a(\lambda-1)}{\varepsilon_L^S}} \tag{5.15}$$

$$\frac{r_L^P - r_D}{r_D} = \frac{\frac{\alpha^A + \alpha^P}{\varepsilon_D} + \frac{1}{\varepsilon_L^P}}{a + 1 - \frac{1}{\varepsilon_L^P}} \tag{5.16}$$

Proof. *see appendix.* ■

We see that the inability of PEs to lobby increases their spread $\frac{r_L^P - r_D}{r_D}$ further. ((5.16) has a higher numerator and a lower denominator compared with (5.13)), corresponding to a relatively even higher loan interest rate than the one faced by the SOEs. Therefore, PEs are more discriminated against if they cannot lobby due to certain reasons (institutional obstacles, too dispersed to cooperate, etc.). The greater the share of the population belonging to PEs, and the smaller the loan-demand interest-rate elasticity of PEs, the higher $\frac{r_L^P - r_D}{r_D}$.Intuitively, PEs are more discriminated against if non-lobbying PEs are larger in size and if their loan demand is less responsive to interest-rate changes.

5.3.3 Regulator's problem in an open economy

When the country is open to the world capital market and faces an exogenously given world interest rate r^{**}, domestic credit supply does not need to be equal to domestic credit demand, and the difference can be met by either international capital inflows or outflows. This section analyzes the political economy determination of interest rates in a financially open setting. We first make further assumptions and distinguish two situations on the basis of

if government can make lump-sum transfer to banks to cover their lost. Lump-sum transfer will not affect the first order condition in regulator's welfare maximization problem. Therefore, equation (5.14) remains the same when lump sum transfer takes place in each period.

the directions of capital flows. Then we determine the interest-rate choices of the regulator with or without political distortions. It turns out that when political elements are absent, capital inflow and outflow situations lead to the same interest-rate level choice, which mimics the result of the competitive markets. But when lobbying activities are possible and an ideological bias exists, capital inflow and capital outflow situations lead to distinct results – and the distinction between these two situations is necessary and important.

Assumptions

(1). When at equilibrium there is capital inflow ($D(r_D) < \alpha^S L(r_L^S) + \alpha^P \theta L(r_L^P)$), we assume that domestic deposits are sufficient for SOEs' loan demand alone but insufficient for SOEs' and PEs' loan demand together. We also assume that the loan demand of SOEs is fully met by domestic deposits, and that capital inflow only goes to PEs to fulfill their loan demand that can not be met domestically. Under this assumption, the profit of banks is derived from loans to SOEs, (which meets their loan demand fully), and from loans to PEs, (only their partial demand is met by domestic credit supply). Specifically, the profits of banks are

$$V^B = (r_L^S - r_D)\alpha^S L(r_L^S) + (r_L^P - r_D)(D(r_D) - \alpha^S L(r_L^S)) \tag{5.17}$$

To equalize the domestic return rate of capital inflow (r_L^P) with the world return rate, the tax authority taxes or subsidies capital inflows at level T,

$$T = (r_L^P - r^{**})(\alpha^S L(r_L^S) + \alpha^P \theta L(r_L^P) - D(r_D)) \tag{5.18}$$

If at equilibrium the loan interest rate of PEs is lower than the world interest rate, then the tax authority has to subsidize the capital inflow in order to provide enough incentives for foreign capital to flow in (correspondingly, $T < 0$). Otherwise, when $r_L^P > r^{**}$, the tax authority could tax away the additional return of capital inflows to PEs (correspondingly $T > 0$).

(2). When at the equilibrium interest rate there is capital outflow ($D(r_D) > \alpha^S L(r_L^S) + \alpha^P \theta L(r_L^P)$), then the profit of banks is derived from providing the domestic credit to SOEs and PEs. Specifically, the banks' profit is

$$V^B = (r_L^S - r_D)\alpha^S L(r_L^S) + (r_L^P - r_D)\alpha^P \theta L(r_L^P) \tag{5.19}$$

The deposit surplus will flow outside of the country. The tax authority taxes or subsidizes the returns of the capital outflow to equalize domestic return with the international return. Specifically, the tax authority's amount of tax or subsidy due to this return-equalization activity is

$$T = (r^{**} - r_D)(D(r_D) - \alpha^S L(r_L^S) - \alpha^P \theta L(r_L^P)) \tag{5.20}$$

If at equilibrium the domestic deposit interest rate is lower than the world interest rate, the additional return from the capital outflow will be taxed away (correspondingly $T > 0$); otherwise, a subsidy will be given and $T < 0$.

We assume that the tax authority treats T in a lump-sum way; T will thus be deducted (when $T < 0$) or added (when $T > 0$) to the depositors' surplus on a one-to-one basis in the regulator's social-welfare function.

Social optimal case

Proposition 5.4 *When the regulator sets interest rates to maximize social welfare, defined by* $\Omega = \sum_i W^i + T = \sum_i V^i + T (i = D, S, P, B)$, *she will set* $r_D = r_L^S = r_L^P = r^{**}$. *Denote* r^* *as the domestic interest rate that will clear the credit market in a closed economy. Then, if* $r^{**} < r^*$, *there is capital inflow; otherwise, there is capital outflow.*

Proof. *see appendix.* ■

Again, this proposition shows that in the absence of political distortions, the regulator's interest-rate choice mimics the competitive market result. It is very easy to show that the share of the total credit going to PEs remains as $\frac{\alpha^P \theta}{\alpha^S + \alpha^P \theta}$ in a financially open economy. Moreover, the higher the productivity of PEs (bigger θ), the higher the domestic market-clearing interest rate (given the world interest rate), the more possible that r^{**} is smaller than r^*, and the more chance that the country is a capital-importing country.

Capital flow with ideological bias and lobbying

However, if political distortions exists, the ideological bias towards SOEs and the lobbying activities of SOEs, banks and PEs for favored interest-rate settings will lead to interest rates set differently from the world interest rate. We characterize the equilibrium interest rate in capital inflow and capital outflow situations respectively.

Case 1: capital inflow Assume throughout this section $D(r_D) < \alpha^S L(r_L^S) + \alpha^P \theta L(r_L^P)$, which will be verified at the equilibrium. Denote $[\alpha^S L(r_L^S) + \theta \alpha^P L(r_L^P) - D(r_D)]/\theta \alpha^P L(r_L^P) = k > 0$, indicating the share of PEs' total loan demand met by capital inflow. The regulator maximizes aggregate welfare (with a biased attitude towards SOEs) plus total contributions made by SOEs, PEs and banks. The tax authority subsidizes or taxes on capital inflows depending on whether the loan interest rate of PEs is lower or higher

than the world interest rate, as described in assumption (1) of subsection 5.3.3. The tax authority's revenue or payout as measured by T (see equation (5.18)) directly enter into the aggregate welfare. We formulate the regulator's maximization problem in detail in the appendix. By solving the problem, we obtain the following result.

Proposition 5.5 *In an open economy with capital inflow going to PEs, when the regulator has a biased attitude towards SOEs, and SOEs, PEs, and banks can make contributions to the regulator to influence the interest-rate choice, a common agency-type, two-stage game leads to the following political economy equilibrium,*

$$\frac{r_L^P - r^{**}}{r_L^P} = -\frac{k}{a\varepsilon_L^P} \tag{5.21}$$

$$\frac{r_L^P - r_D}{r_D} = \frac{\frac{\alpha^A}{\varepsilon_D} - \frac{k}{\varepsilon_L^P}}{\frac{k}{\varepsilon_L^P} + a + 1} \tag{5.22}$$

$$\frac{r_L^S - r_D}{r_D} = \frac{\frac{\alpha^A}{\varepsilon_D} - \frac{(\lambda-1)a}{\varepsilon_L^S}}{\frac{(\lambda-1)a}{\varepsilon_L^S} + a + 1} \tag{5.23}$$

Proof. *see appendix.* ■

First, all interest rates are set below the world interest rate[9]. One immediate implication is that $T < 0$, which means that the tax authority subsidizes capital inflow because the domestic return of loans to PEs is smaller than the world interest rate. A greater subsidy rate will be given to capital inflow if PEs rely relatively more on capital inflow measured by k, if the regulator values contributions more (compared to social welfare), or if PEs have lower interest-rate elasticity.

Secondly, the order of r_L^S, r_L^P and r_D is the reverse of the order of $\frac{(\lambda-1)a}{\varepsilon_L^S}$, $\frac{k}{\varepsilon_L^P}$, $\frac{\alpha^A}{\varepsilon_D}$. For example, when $\frac{k}{\varepsilon_L^P} < \frac{(\lambda-1)a}{\varepsilon_L^S} < \frac{\alpha^A}{\varepsilon_D}$, $r_L^P > r_L^S > r_D$. The diminished importance of the imported capital for PEs will cause the regulator to rank her loan interest rate highest, showing more discrimination towards PEs; more attitude bias towards SOEs leads to a lower loan interest rate, indicating more subsidy to SOEs; recall that α^A measures the share of the unorganized population that are excluded from lobbing activity; a larger unorganized

[9]Therefore, $r^{**} < r^*$ is sufficient condition to ensure that at political equilibrium interest rates $D(r_D) < L(r_L^S) + \theta L(r_L^P)$ by the following logic. Firstly, if $r^{**} < r^*$ there is capital inflow. Secondly, when at equilibrium all deposit and loan interest rates are all set below world interest rates, decreasing domestic deposit supply and increasing domestic credit demand, more capital inflows are necessary. So $D(r_D) < L(r_L^S) + \theta L(r_L^P)$ holds at the equilibrium.

population in the economy results in a lower deposit interest rate, meaning that depositors lose more. Therefore, interestingly, k, λ, and α^A, all scaled by the corresponding elasticities, indicate the relative political strength (for PEs and SOEs) or weakness (for depositors) of PEs, SOEs, and depositors to influence the interest rate set with respect to their own interest.

Thirdly, the relative interest-rate spread between r_L^S and r_D, or between r_L^P and r_D, decreases with both the interest rate elasticity of depositors and the weight attached to social welfare. The same interpretation applies as in the closed economy case.

Case 2: Capital outflow We turn to the case $D(r_D) > \alpha^S L(r_L^S) + \theta\alpha^P L(r_L^P)$. Denote $[D(r_D) - \alpha^S L(r_L^S) - \theta\alpha^P L(r_L^P)]/D(r_D) = e > 0$, indicating the share of total deposits flowing out of the country. The regulator maximizes aggregate welfare (with a biased attitude towards SOEs) plus total contributions made by SOEs, PEs and banks. The tax authority taxes or subsidizes on capital outflows depending on whether the domestic deposit interest rate is lower or higher than the world interest rate, as described in assumption (2) of subsection 5.3.3. The tax authority's revenue or payout as measured by T (see equation (5.20)) directly enter into the aggregate welfare. We formulate the regulator's maximization problem in detail in the appendix. By solving the problem, we obtain the following result.

Proposition 5.6 *In an open economy with capital outflow when the regulator has a biased attitude towards SOEs, and SOEs, PEs, and banks can make contributions to the regulator to influence the interest-rate choice, a common agency-type, two-stage game leads to the following political economy equilibrium:*

$$\frac{r_D - r^{**}}{r_D} = \frac{e - \alpha^A}{a\varepsilon_D} \tag{5.24}$$

$$\frac{r_L^P - r_D}{r_D} = -\frac{e - \alpha^A}{(a+1)\varepsilon_D} \tag{5.25}$$

$$\frac{r_L^P - r_L^S}{r_L^S} = \frac{a(\lambda - 1)}{(a+1)\varepsilon_L^S} \tag{5.26}$$

Proof. *see appendix.* ■

First, whether capital outflow is taxed or subsidized is determined by whether the domestic deposit interest rate is set below or above the world interest rate. From equation (5.24) we know that when $e < \alpha^A$, we have $r_D < r^{**}$; then, capital outflow is taxed ($T > 0$) and smaller e and larger

α^A will lead to a higher tax rate on capital outflow. Intuitively, when a lower share of domestic deposit is exported and more depositors belong to the unorganized group, depositors' economic influence (measured by higher e) and political influence (measured by lower α^A) becomes less important. The deposit interest rate is thus set below the world interest rate and capital outflow is taxed. The capital outflow subsidy is in force when $e > \alpha^A$. This happens to a massively capital-exporting country or to a country with widely organized depositors.

Secondly, the order of r_D, r_L^S and r_L^P is determined by the reverse of the order $\frac{\alpha^A - e}{a\varepsilon_D}$, $\frac{a(\lambda-1)}{\varepsilon_L^S}$,and 0, correspondingly. For example, if $\frac{a(\lambda-1)}{\varepsilon_L^S} > \frac{\alpha^A - e}{a\varepsilon_D} > 0$, then $r_L^S < r_D < r_L^P$. We can regard $\frac{a(\lambda-1)}{\varepsilon_L^S}$ as any indicator of the strength of SOEs to get r_L^S set low and to get a subsidy for themselves. Their strength increases if the regulator has more ideological bias and the elasticity of loan demand of SOEs is low. $\frac{\alpha^A - e}{a\varepsilon_D}$ measures the weakness of the depositors' exertion of political influence that could be brought to bear to induce a high r_D. More unorganized depositors and less capital exporting corresponds to a reduced ability of depositors to get a high deposit interest rate, leading to a low deposit interest rate in the equilibrium. Since PEs do not receive any special treatment from the regulator, and capital outflow refers only to the depositors, the relative ability of PEs to exert political influence is "zero".

5.4 China's case (1980-2004)

In the past two decades, despite the rapid marketization process of the Chinese economy overall, the market-oriented reforms of the financial sector lag far behind: banks are still mainly owned by the state, competition among banks is low, entry barriers are high, etc. (see, for example, van Gemert (2001) for an overview of the Chinese financial system under transition). In particular, the interest-rate liberalization process is slow, and loan and deposit rates have been, until quite recently, especially tightly controlled. We now apply our political economy model to analyze the Chinese case, trying to pin down the political economic forces and environmental economic changes that have driven the Chinese interest-rate-level dynamics and liberalization pace.

5.4.1 Background: pre-1984

Transformation from budgetary finance to intermediary finance

China had sustained an average rate of national savings of more than 25% since the 1950s. But before 1978, the year marking the initiation of "the reform and open policy", this high rate of savings was mobilized almost entirely through the government. Household financial savings were insignificant[10]. Investment was financed predominantly from interest-free budgetary grants[11], which were actually the source of much of the working capital of SOEs. Banks made few loans to SOEs to finance their investment in fixed assets, and concentrated their lending on providing a portion of the working capital.

The initial years of reform (1978-1984) were marked by important changes in the sources of both savings and investment. On the savings side, the decentralization of financial resources into the hands of households led to an explosion in household savings deposits. On the investment side, bank loans replaced the state budget appropriations as the main source of investment finance. The composition of funds allocated to SOEs changed rapidly from budget appropriations in 1978 (70%) to state bank loans in 1982 (80%) (Mehran, 1996). Dating from 1984, bank loans became the chief source of external funding for industrial enterprises (Fan and Woo, 1992). The change in the structure of savings and sources of investment since 1984 has highlighted the importance of financial intermediaries in resource allocation.

Change from mono-bank to two-tiered banking system

Pre-reform China had a mono-bank system typical of a planned economy, revolving around the People's Bank of China (PBC). Although in 1979 there was some institutional transformation of the financial sector (mainly the re-establishment of the Agricultural Bank of China), the separation of the Bank of China from the People's Bank of China, and the functional enhancement of the Construction Bank (by removing the administrative control of the Ministry of Finance), these reform steps were still modest. Far more significant institutional change began in 1984, when the deposit-taking and lending functions of the People's Bank of China were taken over by the Industrial and Commercial Bank. The PBC itself was thus organized into the Central

[10] In the years prior reform, the annual additions to household financial savings were equal to only about 0.5% of GNP. In 1978 the entire accumulative stock of household savings was only about 6% of that year's GNP (Lardy, 1998).

[11] The principle source of the prominent government savings was the profits of SOEs that were surrendered to Ministry of Finance.

Bank of China[12]. This reform led to the creation of the two-tiered banking system in China.

5.4.2 Institutional features

Bank-based financial structure

Throughout the period analyzed, the transfer of funds from savings to investment in China took place mainly through the banking system. During 1980s and 1990s, China's equity and bond financing always accounted for less than 10 percent of the financial system, indicating the underdevelopment and limited role of equity and bond markets in transforming savings to investment. The banking system, with four major state-owned banks taking around 70% of total loans and deposits (data in year 1999), instead plays a crucial role in the allocation of financial resources in China. Thus, deposit and loan interest rates became particularly important in allocating funds, mobilizing savings and directing international capital flows for China. The theoretical model of the chapter, which studies the role of banks in channeling funds and focuses on deposit and loan interest rates, thus reflects the Chinese financial structure.

Regulated interest rates and directed credit

Despite the decentralization of the source of finance, and the institutional establishment of a two-tiered banking system in 1984, the banking system still played a rather limited role in financing investment. Most types of interest rates were regulated. Banks initially had no room at all to adjust rates, and followed the directed rates on a one-to-one basis. Later on, Chinese banks received some limited capacity to charge differential rates of interest, but mainly on the basis of ownership and size of the loan applicants. Only quite recently have banks received more room in adjusting interest rates, and started to practice charging different interest rates on a commercial basis.

During the periods analyzed, loans were, most of the time, directed under the credit plan, and neither the project's profitability nor the borrower's repayment ability was taken into consideration in granting loans. Furthermore, the banks' monitoring of SOEs was almost non-existent (Tong 2002).

[12]However, it assumed normal central bank functions only gradually.

Politically oriented interest-rate setter and government intervention at various levels

Although the People's Bank of China by name should be the setter of various types of interest rates, the PBC is far from independent and must ask permission from the State Council for each interest rate change. The final decision maker is not the state council, however, but "the Central Economic and Financial Leading Group", which became later "the Central Financial Working Commission" (established in 1998 after the Asian financial crisis) of the Chinese Communist Party. This body is the final decision-maker for various important financial policies, certainly including the interest-rate-setting mechanism and level changes. Not surprisingly, the interest-rate-setting process is very much politically oriented.

The overall structure of authority from top to bottom also made it difficult to limit political intervention in loan allocation. On the one hand, the Chinese authority consists of multiple levels of government and the communist party branched at the national, provincial, city or county, and township levels; on the other hand, the government also consists of functional bureaucracies duplicated at each of those administrative levels. Given that most (if not al)l of the vertically organized governmental agencies face budgetary constraints, it is in their interest to pursue policies that enhance their own material resources. The local governments inevitably press the local branches of the state banks to grant the SOEs' application for investment loans. Evidence overwhelmingly shows that the local bank branches have generally not been able to resist the demand of easy money.

Although not officially recognized and institutionally legitimated, various interest groups, such as SOEs, PEs and banks, have become more active as the reform proceeds. They use various means to influence the regulator-set policies to their own advantage.

5.4.3 Observations on interest-rate data

Figure 5.1 plots time-series data of deposit and loan interest rates over the period 1980-2002 both in nominal terms (Figure 5.1.1) and in real terms (Figure 5.1.2.), which are deflated by an annual GDP deflator. Figure 5.2 shows the change of the interest-rate spread over time. We summarize the information conveyed by the figures as follows.

1. Levels: Overall except real interest rates in some high inflationary years, which were below zero (during three periods China met high inflation: 1985, 1988, 1993-1995), the rest of the real interest rates

were low and above zero. Look carefully, at the average, before 1996, real interest rate was low. From 1996 on, the real interest rate started to increase.

2. Spread: Overall, the interest-rate spread in China is small[13], and the interest rate spread started to increase, only since 1995, to 2.61, and remained at 3.6 for several years until 2001.

There are several preliminary observations. First, low levels of the real interest rate – especially at the beginning of the periods – are indicative of the "financial repression" policy practiced in China. Secondly, advanced countries generally possess more efficient financial intermediation and a more competitive banking sector, both contributing to a lower interest-rate spread. China's banks are less efficient, however, due to state ownership and a relatively concentrated banking structure. The surprisingly low interest-rate spread of China therefore strongly implies that some other factors than concern for efficiency dominate. Thirdly, roughly the whole period to be analyzed could be divided into two sub-periods. Before 1996, both spread and levels were low, with even a sporadic negative or zero spread or a negative real interest rate; after 1996, both spread- and interest- rate levels increased, and neither are currently negative.

5.4.4 Regulated interest rate and biased lending (1980-1996)

Current situation

Price discrimination: effective interest rates to PEs It is not easy to obtain data on the effective interest PEs paid from the official sources, despite the fact that most private enterprises that are able to borrow already pay effective interest rates that are significantly higher than the ones prescribed by the Central Bank. Banks and credit unions are also using "creative" ways to circumvent interest-rate controls when granting loans to PEs. According to firm survey (World Bank, 2000), in 1992, state-owned commercial banks charged an average interest rate of 7.9 percent, and credit unions 11.5 percent,

[13] They are exceptionally small compared to other countries. The world average interest rate spread between year 1984 and 2002 is 10.57%. For OECD countries, the number is 5.38% and 11.83 for non-OECD countries. China's average is only 1.50% for the same period, ranked as lowest No.4. among 164 countries. (WDI 2002). List the interest rate spread average for some of other countries: South Korea (0.59), Canada (1.54), Swithzerland (1.83), the United Kingdom (1.97), Japan (2.74), Tailand (3.00), Phillipine (5.20), Germany (5.78).

on borrowers from the non-state sector. These rates, with transaction costs factored in, are comparable to the informal market rate. Moreover, from April 1991 to August 1996, both collectively owned and privately owned enterprises were explicitly asked to pay a working-capital interest rate that floated up to 20% of the basis rate applying to SOEs (Chinese Financial Yearbook and Chinese Yearbook, 1997).

Quantity discrimination: lending bias against PEs The phenomenon of lending bias in favor of SOEs has been widely documented (see McKinnon, 1994; Lardy, 1998; and Aziz and Duenwald, 2002). Admittedly, small and opaque private firms have difficulty obtaining external financing because they represent higher risks and high unit-transaction costs. But the lending bias in favor of SOEs in China is particularly rooted in a policy choice made by the authorities to commit massive financial resources to the state sector.

There is a great deal of direct evidence showing the lending bias. For example, between 1991 and 1997, the share of private investment in the national total was in the range of 15-20%, with little recourse to formal bank loans (less than one percent of working capital loans went to the private sector) (World Bank, 2000). Using city-level data over 1989-1991, Wei and Wang (1997) examine the connections between the Chinese state-owned banks and SOEs. They find clear evidence that bank lending is biased in favor of SOEs: Cities with a higher SOE' share in output are more likely to experience faster growth in loans – even after one takes into account the cities' size, capital intensity and beginning-of-sample loan-to-output ratio.

Indirect evidence is acknowledged to a lesser degree. Table 5.1 shows how the loan-to-deposit ratio varied for three typical Chinese provinces from 1988 to 1999. Less than 1.0 would indicate that the province as a whole was not lending out as much as it was receiving in deposits, and that the province was a net supplier of capital. The table indicates that on the whole, Fujian and Zhejiang experienced capital outflow, and Henan capital inflow. The former two provinces(coastal south of China), however, have a higher proportion of non-state sector and economically outperform the latter province (northern central China), whose economic structure is dominated by the state sector. This inconsistency demonstrates that the center was reallocating financial resources biased toward the SOE-concentrated region.

The significance of the administratively allocated funds (referred to as "policy loans") provided more indirect evidence of the lending bias. An example: policy lending as a percentage of total lending in 1991 was as follows: Bank of China, 67%; Agricultural Bank, 52.2%, Construction bank, 58 %; and Industrial and Commercial Bank, 25% (Lou, 1993). Overall policy

lending of the four banks as a group constituted 42% of all lending at year-end 1991. World Bank (2000) estimates indicate a similar result: the outstanding stock of policy lending at the beginning of the 1990s reached about one-third of the total outstanding loans extended by the banking system. Policy lending is normally defined as government-directed credit allocations toward nationally or locally defined industrial priorities. Industrial priorities are chosen according to the overall interest of the nation or the region. However, it was hard to discern policy lending from SOE biased lending, and many of the policy lending cases were de facto SOE biased lending in the name of "policy lending".

What should happen: the optimal credit allocation

Efficiency gap: θ The efficiency of using capital in the SOE sector was relatively low. In 1997, the ratio of value added to fixed assets for SOEs was 37% compared with 56% for shareholding companies, 61% for foreign companies, and 94% for collectively owned firms (Heytens and Karacadag, 2001).

Table 5.2 shows that the average capital-to-output ratio for SOEs was almost twice that of non-state enterprises in 1996. It was more than twice the capital-to-output ratio of the private and individual enterprises, and significantly higher than that of foreign-invested enterprises. These numbers, to certain extent, indicate the SOEs' low efficiency of investment.

Admittedly, the higher capital-to-output ratio in SOEs could be due to the concentration of state-owned enterprises in capital-intensive industries, but disaggregated data suggest otherwise. Food processing and textiles are generally less capital-intensive than machinery, chemical, automotive, and electronics industries. In all six of these, SOEs had much higher capital-to-output ratios than did non-state enterprises (Tong, 2002).

Relative share changes: $\frac{\alpha^P}{\alpha^S}$ Despite the fact that the non-state sector emerged on the fringes of the Chinese economy in the early 1980s, the actual size of its growth was significant. The growth of the non-state sector throughout the 1980s was characterized by the growth of township and village enterprises, which are owned either by local communities or governments or by rural households (and are therefore quasi-privately owned). Moreover, due to the negative ideological stereotype associated with the pursuit of private profit, many de facto private businesses disguised their ownership structure by registering as "people-run enterprises" (Minying Qiye), carrying a less nakedly capitalistic connotation. Since the 1990s, other types of non-state enterprises, including private and individual enterprises, and foreign-invested

enterprises, have grown rapidly. Moreover, the delayed ownership reform in 1995 of SOEs took the first steps – in divesting and laying off employees – toward changing the ownership structure on a large scale. The focus of the 1995 SOE reform was to privatize small enterprises and to commercialize large ones under the principle of "seize the large and release the small" *(zhuada fangxiao).* The government decided to keep under its ownership 500 to 1,000 large state firms and to reform the smaller SOEs through a package of policy measures including reorganizations, mergers, acquisitions, leasing, and sales. The ownership reform of SOEs further added to the size of the non-state sector.

Not only has the size of the non-state sector grown rapidly, but also its contribution in the total volume of China's national economy has risen, especially since 1992. This can be seen in the following indicators. From 1992 to 2001, the proportion of the total industrial output by the non-state-owned industry in that of national industry rose from 48.5% to 78.3%; the proportion of the non-state-owned sector with respect to urban employment rose from 39.03% to 68.09%.

Table 5.3 summarizes the growth of the non-state sector between 1989-1998. The number of private enterprises grew at an average rate of 33% per year, much faster than the growth of the numbers of state-owned and collectively owned enterprises. The workforce in the private sector also grew by almost 30% per year during the same period, compared with a slight decline of the workforce in state- and collectively-owned enterprises. The output of private enterprises had increased at an extraordinary rate of 52% annually between 1989-1998.

Overall, on the basis of the theoretical model, the optimal allocation of credit to the non-state enterprises should be an increasing function of θ and the relative share of PEs, measured by $\frac{\alpha^P}{\alpha^S}$.Due to the existence of the productivity gap and the increasing share of PEs, it is expected that PEs should get relatively more credit (compared to SOEs). However, this is not what is actually happening.

Reasons

Unorganized depositors with low deposit-supply elasticity Depositors in China were a large and dispersed "group", with a high proportion of the population remaining in the agricultural sector. The free-rider problem strongly affected them when trying to take collective action. Therefore, as a whole they can not "lobby" for a high deposit interest rate. In the model, higher α^A, (meaning that more depositors are out of the lobbying process) is associated with a lower deposit interest rate. A lower deposit interest rate

actually implies that there is an income transfer from depositors to banks and enterprises.

Several independent econometric analyses (Xu, 2002; and Li, 1999) on the relationship between the interest rate and the saving rate applied to varied periods of time in China have obtained the similar results: the nominal interest rate has an insignificant impact on the saving rate, and the real interest rate has insignificant positive effects on savings. Several reasons may account for the lack of deposit-supply interest-rate elasticity in China: (1). the lack of a deposit substitute, such as equities, bonds, and insurance policies, etc.; (2). the precautions and liquidity dominated motivations for savings; (3). the lack of depositors' experiences in adjusting their portfolios according to returns. In the model, a low interest-rate elasticity of deposit is associated with a relatively low deposit interest rate as well.

Ideological bias against PEs Until 1988 (at which time PEs already started to emerge), there was no Constitutional recognition of the property rights of them, indicating a foremost bias against PEs. Article 11 of the 1982 Constitution acknowledged only the property rights of individual enterprises—defined as self-employed family businesses. The conspicuous silence on the property rights of private firms stemmed from an ideological consideration. Since private firms were defined as those with more than eight hired employees, their operations raised the specter of exploitation by private capital owners.

In 1988, Article 11 was amended to include a clause saying that the state permitted PEs and that the state was to protect their "lawful rights and interests." However, the amended article reserved the right of the state to exercise "guidance, supervision and control over the private sector of the economy." As if the vested power of the state to supervise the private sector was not sufficient, the amendment also carefully subordinated the private sector as "a supplement to the socialist public economy."

The ideological discrimination against PEs lasted throughout the 1980s and the beginning of 1990s. In the model, $\lambda > 1$ results in a relatively high loan interest rate to PEs. The higher the λ, the greater the interest-rate gap between SOEs and PEs.

Significant lobbying ability of SOEs with low interest-rate elasticity of loan demand State-owned enterprises in China have many stakes in common and could collectively lobby the regulator to set loan interest rates low. An additional channel (not directly captured in the theoretical model) through which state-owned enterprises could lobby for favorable interest rates

was the regulator's concern regarding unemployment. SOEs' frequent warning to the regulator on the negative impacts of high loan interest rates on employment together with Ministry of Finance's unemployment benefit burden could further increase the effectiveness of the lobbying ability of SOEs. In addition, the unemployed as a group were normally more likely to express their demands by collective expression.

The phenomenon of the "soft budget constraint" of SOEs is widely documented . Since "soft budget" reduces the responsiveness of deposit demand to interest-rate changes, ε_L^S is small.

In the model, the SOEs' ability to lobby added to the ideological bias towards SOEs, and thus more weight was put on to SOEs in the regulator's social welfare function, corresponding to a relatively lower loan interest rate of SOEs. A small ε_L^S also leads to a lower loan interest rate that SOEs face.

Subordinated banks with less autonomy In the early years of the reform, the Chinese banking industry was dominated by state-owned banks. It was hard to separate independently the interest of those state-owned banks from the state. These banks mainly served as tools for facilitating the government's financial policies. Due to the lack of the bank autonomy and their independent interest, they had few incentives to lobby the regulator to set interest rates in their favor. In the special case 1 of Proposition 5.3, when the banks can not lobby and SOEs obtain ideological bias, the interest-rate spread is negative. This was consistent with the very low interest-rate spread (with sporadic, zero or negative level) before 1996 in China.

In sum, the political economy model of interest-rate liberalization provides a powerful tool for understanding the late deregulation of the interest rate in China until 1996. The low and regulated interest rate, the low interest-rate spread, and the biased credit in terms of price and quantity, rather than a desirable gradually liberalized interest rate, reasonable spread, and nondiscriminatory credit policy, were primarily the political economic equilibrium reached by different interest groups. Moving this equilibrium would require either changes in the relative strengths of interest groups or some institutional shocks.

5.4.5 Trend of interest-rate liberalization (1996-2004)

Changes

China officially initiated interest-rate liberalization in 1996, and assumed a gradual and piecemeal policy thereafter. The first step was to liberalize the interbank interest rate on June 1st, 1996. Then, in June 1997 and October

1999, bond repurchasing and treasury bond interest rates were liberalized. On September 21st, 2000, China started to liberalize the interest rates of the large deposits and loans denominated in foreign currencies. Deposits below 3 million dollars retained the interest rate at 5.5% set by the rules; the marginal amount above 3 million dollars would have its interest rate set on the basis of LIBOR. The scope for banks to adjust their interest rate on the basis of the regulated loan and deposit interest rate was gradually enlarged. As of October 1998, the loan interest rate to small enterprises could float up 10% to 20% compared to the base value. As of September 1999, the loan interest rate to small- and medium- sized enterprises could float up 30%; for big enterprises, it remained at 10%. On March 21st, 2002, eight selected rural cooperatives were allowed to float the deposit interest rate up from 20% to 50%, and the loan interest rate to 100%. A significant step was taken in October 2004: the loan interest rate could be adjusted by banks within the range [0.9, ∞) of the rate basis and the deposit interest rate within the range [-∞, 1] of the rate basis. Thus, China shifted to a loan-rate floor and deposit-rate ceiling regime.

Not only did interest rates start to liberalize, but also the formerly biased lending towards SOEs has lessened. From 1996 to 1998, the annual growth rate of the total lending stock of the financial institutions was 17.2% to the state sector and 27.3% to the non-state sector. During the same period, the proportion of newly granted loans to the non-state sector grew from 38.87% to 45.82%. At the end of 1998, the four state-owned banks granted 32.8% of their total loans to the non-state sector, and among the total loans granted to the non-state sector 48.6% originated from four state-owned banks[14]. The latest statistics[15] show that in 2003, the SOEs took only 17.22% of the total newly granted loans. As far as working capital is concerned (at the year-end of 2003) the total stock of working capital loans to SOEs was 35.72% and 34.11% at the end of the first quarter of 2004.

Domestic reasons

PEs begin to lobby Due to the arrival at a critical mass and the increasing awareness of their own common stake, the private enterprises started to lobby the regulator. The model (compare special Case 3 of Proposition 5.3 with Proposition 5.3) shows that ability of PEs to lobby relative to that of the SOEs, reduces their loan interest rate.

[14] People's Bank of China, Statistic Division.

[15] Governor Zhou of People's Bank of China, The International Finance Conference, Shanghai, 2004.

Reduced ideological bias: λ Since 1992, the government has adopted more positive and open policies in the form of regulations and laws in favor of the non-state-owned sector. In November 1993, the Central Committee of the Communist Party of China stated that "the State shall create conditions for economic sectors of all types of ownership to participate equally in the market competition and all types of enterprises shall be treated alike".

Furthermore, in March 1999 the Chinese Constitution acknowledged the private sector as an integral part of the Chinese economy and conferred an equal status on private firms with other firms. Private economy is now a "component" of, rather than a supplement to, the Chinese economy. This represents a major change in the government's commitment to the private sector, which is no longer temporary, expedient or tentative (as was the case during the late 1980s and early 1990s). Less ideological bias reduces the gap of loan interest rates between SOEs and PEs.

Increased loan-demand elasticity of SOEs and decreased α^A Some progress has been made in hardening the budget constraint of SOEs, such as the transformation of the corporate governance structure, better designed incentive schemes, modernized internal management, etc. The resulting increase of the loan-demand elasticity has resulted in a reduced subsidy to SOEs when the regulator chooses various interest rates given other parameters.

At the same time, industrialization and the urbanization process have resulted in a smaller population left in the unorganized agricultural sector, thereby increasing the politically influencing power of depositors.

Increasingly autonomous banks Since 1993, China's financial sector reforms have focused on commercializing the lending operations of banks. Reforms were initiated by establishing three policy banks[16], designated to be the main vehicles for policy-based lending in the future, to relieve the four large state-owned banks of their own operations and to pave the way for further commercialization of banks. A range of reforms introduced in recent years included limiting local government interference in bank lending decisions[17], abolishing the credit plan[18], recapitalizing the banks through a RMB (Renminbi, Chinese currency) 270 billion bond issue in 1998, and initiating a

[16] They are the State Development Bank, The agricultural Development, and the Export-Import Bank of China.

[17] Because of tendency of the provincial-level people's bank of Chinas to succumb to local political pressures for subsidizing SOEs, they were replaced by nine cross-provincial regional PBCs in 1999.

[18] In 1998 the government phased out the credit quota system that were applied to the four state owned banks and replaced with asset liability management.

debt-for-equity swap during 1999-2000. Internal reforms of the state-owned banks included the revamping of loan approval and analysis procedures, introducing more incentive-based compensation systems, rationalizing branches, and reducing staff. Overall there was increasing recognition of the banks' own interest and a gradual separation of state-owned banks from the government.

Market participants were increasing; so was the extent of competition. Apart from four state-owned banks, four more other nationwide commercial banks were established[19] between the mid-1980s and 1996. In the mid-1990s, China also established a number of regional banks. Moreover, urban credit cooperatives were formally authorized as new shareholding financial institutions in 1986. These new market participants compete, more or less, with existing state banks by providing better services to depositors and non-state enterprises. For example, at year-end 1995, more than half of the urban credit cooperatives' loans outstanding were to collective firms, and another 8 percent went to private firms (Lardy, 1998). Although state banks dwarfed the urban credit cooperatives in total lending, during the same year loans outstanding to private firms by urban credit cooperatives were almost five times those of state-owned banks (Lardy, 1998).

The increasing autonomy of state-owned banks enhances their incentives to lobby the regulator. Their small number makes it easy for the state-owned banks to take collective action to capture regulators in order to set interest rates in their favor – and at the expense of the depositors or even enterprises. The model (compare Case 2 with Case 1 of proposition 5.3) reveals that the lobbying ability of banks increases the interest-rate spread and the banks' profit, which indeed occurred in China after 1996.

Uncertainties and limitations

Although China has already been moving toward a liberalized and competitive interest rate regime since 1996, some uncertainties and obstacles still play an important role.

[19] (1) In the mid-1980s the Bank of communications of China established, who pioneered the use of modern banking methods in China. From the outset this bank was not required to undertake directed lending on behalf of the state. Rather it has been able to make its lending decisions primarily on commercial considerations. (2) Two smaller national wide commercial banks were established in 1992-the Everbright Bank, the Huaxia Bank. They are shareholding banks, with provincial and local governments and enterprises as major shareholders. Major sources of funds are enterprise deposits and they mainly serve their stakeholders. (3) In earlier 1996, China's first private shareholding bank, the China Minsheng Bank established, which was in response to the complaints from non-state enterprises on difficulties in obtaining credit from SOB. It mainly served non-state enterprises.

The political economy of the sequence of interest-rate liberalization The official principle guiding the order of Chinese interest-rate liberalization was determined in 2000: from foreign currencies to domestic currency; from loans to deposits; from large amounts and long-term loans or deposits to small amounts and short-term ones. The latest liberalization of interest rates shows that China actually adopts "the loan-rate floor" and "the deposit-rate ceiling" policy. Although one could list reasons to justify the sequence and direction of interest-rate liberalization, we argue that political-economic factors play important roles as well. For example, the lobbying competence of PEs vs. the inability of depositors tends to cause regulators to liberalize loan rates before deposit rates; Since wholesale transactions normally have larger interest-rate elasticity, regulators may consider them more than retail transactions; "The deposit-rate ceiling policy" could be the result of the inability of the unorganized depositors to lobby, and "the loan-rate floor policy" could be serving the banks' interest.

Possible reversal: 1998-2001 Since 1998, the new government has focused on reducing poorly performing loans of state-owned banks and transforming state-owned enterprises so that they would be profitable within three years. Examining figures 5.1.2. and 5.2., we notice that: (1) immediately following the changes in 1998, real deposit interest rates decreased for three successive years from 6.33% in 1998, to 4.54% in 1999, to 1.29% in 2000, corresponding to the decreases of real loan interest rate; (2) the interest-rate spread increased from 2.61% in 1998 to 3.6% in 1999, and remained at 3.6% for the years 2000 and 2001. This change of interest-rate level and spread, which is contrary to the general trend of interest-rate liberalization, is broadly consistent with the prediction of the model: unorganized depositors transferred large incomes to banks and SOEs. It is possible that this type of reversal could happen again in the future.

Ideology residual Over time, the government's policy to reduce ideological disfavor against PEs has often appeared reluctant or begrudging, as the government has continuously tended to be more apt to recognize the de facto situation rather than to break new ground. There has also been, until now, residual ideological opposition to the private sector, which was interestingly revealed in an announcement allowing private entrepreneurs into the Communist Party.

Politicians and the bureaucracy as a distinct interest group Politicians and the bureaucracy could actually be a distinct interest group. Al-

though in the theoretical model we assume that the regulators and the government are the same, they can be different. If so, the government itself will be one interest group – perhaps the strongest one pursuing its own interest. During late 1990s, when domestic demand in China was weak and deflation started, the Chinese government chose expansionary fiscal policy to stimulate domestic demand by issuing a huge amount of government bonds. Since low interest rates would decrease the costs of bond offering and the future government burden, the government itself didn't want a liberalized high interest rate. To include the government as a distinct interest group will be left for future research.

Reasons from outside: De facto partially financial opening

China has maintained an inconvertible capital account from the outset of the reform until now. Many types of capital inflows are restricted and closely monitored, except FDI. Capital outflow is officially even more severely curtailed. At the same time, due to the accumulative current account surplus (a reflection of domestic saving being bigger than domestic investment) and FDI inflows, a huge official foreign reserve has been accumulated and has increased dramatically over time.

Gain or loss when government channels the saving' surplus abroad
Many authors (Guo, 2003; and Prasad and Wei, 2004) have noticed that China has surplus savings, especially in the 1990s. Figure 5.3. plots the gross capital formation, gross savings, and current account balance, all as a percentage of GDP from 1980 to 2002. Not surprisingly, the years with a savings surplus correspond to years with a current account surplus of the same amount. It is obvious that since 1994 China has sustained a continuous savings surplus and current account surplus at 1.5% of GDP on average. For a country with surplus savings, the corresponding net capital outflow can be channeled either through private investors or the public investor, generally the national central bank. Yet in China, due to capital outflow control, although there is significant capital flight, private investors have a rather limited role in channeling capital outflow. As a result, the People's Bank of China channelled China's surplus savings. In addition, due to the substantial amount of FDI inflow (among other types of capital inflow), the People's Bank of China also channelled substantial inflows of foreign private capital out of the country. These unusual investment patterns explain why reserve purchase in China has exceeded China's saving surplus.

Reserve purchases directly increase the monetary base. Central banks normally opt to sterilize their reserve purchase through an offsetting draw-

down in their net domestic assets – either by selling domestic government securities out of their portfolio or by issuing domestic currency securities in their own name (for example, central bank bills). The result is to drain the cash injected into the economy by the reserve purchase, leaving the monetary base unchanged. From end-2000 to end-2003, net foreign assets in China increased 9.2 percentage points relative to GDP, while net domestic assets fell 4.3 percentage points (roughly half of that amount), thus leading to a monetary base increase of 4.9 percentage points of GDP. Because of the insufficiency of existing short-term instruments (mainly government bonds, for open-market operation), the Chinese central bank started to rely on issuing central bank bills to sterilize foreign reserve increases. In most recent years[20], however, due to the extensive amount of "hot money" inflows (expectations of RMB appreciation) and a midst concern about excessive credit growth and potential economic overheating, the pace of sterilization by China's central bank has picked up, with a dramatic increase of central bank bills issued in order to limit growth of the monetary base. Table 5.4 provides quarterly stock data on foreign reserve and central bank bills. Both of their dramatic increases are obvious.

Generally speaking, sterilized reserve purchases come at a fiscal cost. They involve purchasing relatively low-yield foreign assets while issuing relatively high-yield domestic liabilities. Moreover, as sterilization continues, these fiscal costs rise, as the central bank may have to offer ever-higher interest rates in order to induce domestic investors to continue adding central bank securities to their portfolio. The magnitude of the fiscal burden depends on the gap between domestic and reserve currency interest rates.

However, China's low controlled interest rate compared with the returns of treasury instruments of medium- and long-term industrialized countries may imply that there are in fact net benefits to sterilization (see (5.20), when $r^{**} > r_D$, $T > 0$). We compare China and the US real interest-rate differential by different measures.

First, the real-interest-rate differential is measured as the real one-year deposit rate in China minus the real one-year yield on treasury securities in the United States[21]. During the entire 1980s, China's real short-term interest rate was lower than that in the United States, and the gap reached its peak in

[20] At the year-end of 2004, the official foreign reserve is 609,9 billion US$ increased by 206,7 billion US$ compared with end of 2003.

[21] China's real one year deposit rate is equal to the nominal one-year deposit rate minus 12 month changes in the CPI in China. The US real yield on constant maturity one-year treasure securities is the nominal yield minus 12-month changes in the CPI in the United States. The US nominal yield on constant maturity one-year treasury securities is obtained from the Federal Reserve System and the others are based on the IFS and the IMF.

1988-89. Since the early 1990s, the real interest rate differential has narrowed significantly and was relatively close to zero in most portions of this period (except for 1994-96, when the overheated economy induced high inflation(See Jin, 2003)).

Secondly, Cheung et al. (2003) compared monthly interbank interest rates between China and the US from February 1996 (immediately after a unified national interbank market was established) to June 2002. They found that, on average, China's real interbank rate was 3.245% lower than that in the US.

Thirdly, we directly compare China's central bank bill interest rate with the US Treasury bill rate. Over time, the US Treasury bill return rate is about 3%. The available data on China's central bank bill's interest rates are 2.198% (April, 2003), and 2.300% (August, 2004). Again, China's rate is lower than that of the US[22].

In sum, the Chinese central bank's sterilization activity has tended to provide the Chinese government with a net fiscal benefit rather than a fiscal burden. The political-economy-determined low interest rates certainly account for this exception.

Capital inflows relieve PEs' unsatisfied capital demand The rate at which foreign capital has been flowing into China over the last decade is remarkable. The movement in total net inflows has been driven largely by trends in foreign direct investment (FDI), its largest component. From 1979 to 1999, China absorbed a total of $306 billion in FDI, which is second only to the United States, and FDI flows into China account for 30 percent of total FDI going to developing countries. Portfolio inflows have been less dynamic than FDI. China only began in 1992 to allow foreign sales of equities by domestic companies and Chinese companies to list and sell shares on foreign markets. Until recently, the amount of portfolio inflows has been overshadowed by FDI. International borrowing is also much less significant compared to portfolio inflows.

Relative to GNP, inflows of foreign capital to China remained small until the 1900s. Prior to 1991, net inflows of private capital were about 2%, and net FDI about 1%, of GNP. After 1991, both net private capital inflow and FDI rose to more than 5% of GNP. By the mid –1990s, foreign capital contributed to roughly 15% of total investment.

[22]The annual gain for Chinese Central Bank when conducting sterilization activity by issuing central bank bills is 2.30 billion Renminbi. The average holding of central bank bill is 458.12 billion Renminbi (take average of the stock value of the central bank bill in Table 5.4). The interest rate differential is taken as 0.5%. Then 458.12*0.5%=2.30 billion Renminbi.

Where do these capital inflows go? The "political pecking order" theory of Chinese firms raised by Huang (2003) offers some theoretical clues. He argues that the constitutional protection of foreign-invested enterprises (FIEs) far exceeded that accorded to the domestic private firms, although less than SOEs. [23]. From the very beginning of economic reforms, FIEs were accorded a superior legal status, compared with the private firms, despite the fact that FIEs could be 99 percent owned by foreign—and private—investors. The existence of "a political pecking order" implies a disproportionate reliance on FDI by PEs than by SOEs. Chinese private firms have a higher demand for FDI because they are more willing to accept greater foreign controls. For example, a liquidity-constrained private firm may be more willing to accept a large foreign equity stake because it has no other financing recourse. A more privileged firm, SOE, may need foreign equity financing less because it can borrow from a bank. Although Huang logically deduces why PEs rely on FDI at a disproportionately higher rate, it is not feasible, due to data limitations, to provide Chinese evidence to verify his deduction. But a survey done by World Bank (2000) indirectly points toward a similar direction. This survey showed that among the sample of private firms, 23 percent wanted to form joint ventures with foreign firms in order to get capital in the future, and 11 percent said they were willing to borrow from foreign banks. The same numbers are much smaller for the sample of SOEs.

Under the assumption that SOEs' credit demand could be fully met by domestic credit, and that capital inflows merely go to PEs, the capital inflow case of the political economy model predicts that the possibility of PEs getting foreign capital reduces their relative loan interest rate compared to SOEs. Furthermore, the model predicts that the PEs' loan interest rate is chosen below the world interest rate; the regulator therefore needs to subsidize capital inflow. This is indeed happening in China: central and local governments in China have adopted a range of special provisions to attract FDI (including tax concessions, liberalized land-leasing options, government guarantees on loans by foreign lenders to domestic borrowers, etc.).

Capital outflow increases the power of domestic depositors in a financially depressed system Despite the dramatic growth in capital inflows into China, concern has been glowing that quite a lot of capital simultaneously flows out of the country in an "abnormally" unreported way

[23] China's current Constitution, adopted in 1982, clarified and offered protection to the legal status of foreign enterprises operating in China. The foreign enterprises were permitted "to invest in China and to enter into various forms of economic cooperation with Chinese enterprises and other Chinese economic organizations. . . ." (Article 18 of 1982 constitute). The Article also swore to protect their "lawful rights and interests."

(formally referred to as "capital flight"). From 1991 through 1998, China's "net errors and omissions" of balance of payment showed capital flight every year. A positive value one year did not offset a negative value the next, as in other countries. The cumulative capital flight over this period amounted to $101.1 billion, nearly two-fifths of total foreign direct investment in China. Cai (1999) estimated that the ratio of capital flight to inward foreign direct investment was 100% in the year 2000. Similarly, Gunter (2004) estimates that the capital flight from the mainland China was equal to or greater than inward FDI for the 1990s[24].

Relative to GNP, capital flight from China has increased. Gunter's (Gunter, 1996) unadjusted residual estimate rises from about 1% of GNP in the late 1980s to 4-5% in the mid-1990s; the high, adjusted residual estimate rises from about 5% of GNP in 1988/89 to over 12% in 1993/94. By the mid-1990s, capital flight was thus equivalent to somewhere between 12 and 27% of domestic savings. These numbers suggest that a substantial portion of domestic savings was finding its way out of the country.

The result of the capital outflow case of the political economy model illustrates the way in which the surplus of savings can flow out of the country, thereby increasing the political power of unorganized depositors and the relative deposit interest rate.

5.5 Discussion and conclusions

This chapter develops a political economy model of interest-rate determination to explain positively why interest rates could be set differently from the domestic-market-clearing level (when the economy is closed) and the international level (when the economy is open). The model shows that these deviations could be the result of the optimal choice of the regulator, who maximizes her social welfare objective function by factoring an ideological bias and lobbying contributions. The model thus offers useful insights in explaining the depressed level of the interest rate, the size of the interest-rate spread, the credit allocation bias towards certain sectors (hereby the state owned enterprises), and the pace and sequence of interest-rate liberal-

[24]Sicular (1998) focused on the mystery of why China had simultaneously experiencing large amounts of inward foreign capital investment and outward capital flight. She attributed this to the different incentives and return faced by foreign and domestic investors. For example, many FDI appears to be associated with implementing market strategies, exploiting production knowledge, or overcome trade restrictions apart from high returns. The most recent research by Denis and Huizinga (2004) show that foreign ownership could be a substitute for a insufficiency of domestic investors' protection, thus offering another reason why FDI could be driven by non return reasons.

ization. Applying this model to China for the period between 1980 to 2004, we find that the interest groups' lobbying activity and ideological bias are forces underlying the delayed Chinese interest-rate liberalization. Over time, the dynamic changes of the features of interest groups and ideology shift, together with the de facto partial financial opening in China, shake the previous political equilibrium and can largely account for the recent trend of Chinese interest-rate liberalization.

The main messages conveyed by the chapter are the following. First, normative analysis of interest-rate control based on purely economic reasons is not sufficient. Interest-rate regulation and liberalization have significant distributive effects; positive analyses using a political economy approach are thus rewarding. Secondly, to what extent the political economic equilibrium of interest rates favors or disfavors certain players depends on their political and economic strength (associated with their ability to lobby, their interest rate elasticity, and the regulator's ideological bias). The underlying relative change of strength can shake the previous equilibrium. Thirdly, the possibility of having access to the international capital market enhances certain players' political influence in obtaining a better domestic interest-rate setting. Enlarged choice sets of the players formerly disfavored is thus generally a good thing for them. Fourthly, over the past two decades, China's biased and low interest-rate levels, the low interest-rate spread, and the lagged pace and particular path of interest-rate liberalization can – to great extent – be explained by the political economic model. Fifthly, the recent sterilization operations of the People's Bank of China have actually generated net fiscal gains for the central bank, rather than a normal fiscal burden. The depressed domestic low interest rate largely accounts for this gain.

Several points deserve further discussion. First, the model assumes that the credit market clears, ruling out the possibility of credit rationing. Although credit rationing is prevalent in countries like China, it is hard to model who supplies or gets credit when saving rationing or loan rationing happens without using strong ad hoc assumptions. To avoid the "rationing to whom" problem, we therefore assume market clearing as the first step. Secondly, the chapter overlooks the existence of the informal financial market, which in China, as well as in other developing countries, had expanded rapidly. The informal financial market gets savings leaked from formal banks and most often grants loans to satisfy the PEs' unmet credit demand. This chapter's basic conclusion would not change if informal credit markets were also considered. Finally, it is difficult to incorporate both capital inflows and capital outflows into one model, and thereby to explain the coexistence of huge FDI inflow and capital flight (which are of similar magnitude in China). The coexistence could also be the result of consistent political economy equi-

librium, however. For example, if the domestic-market-clearing interest-rate level were below the world level (implying that the country has a savings surplus and is a capital-exporting country), but (perhaps due to political economic reasons) the domestic interest rate was actually set lower than the domestic market-clearing level, then it would be necessary to attract capital inflows with a subsidy to fill the credit shortage. If we further assume that there exists sophisticated vs. non-sophisticated savers (and the former can have access to the international returns), then at the same time there are capital outflows by sophisticated savers. Currently, the analyses of open economies are rather more illustrative than analytical.

Appendix to Chapter 5

5A Proofs

Proposition 5.1

Proof. When the regulator's objective function is to maximize social welfare, she solves the following problem,

maximize $\Omega(r_D, r_L^S, r_L^P) = W^A + W^S + W^P + W^B = V^D + V^S + V^P + V^B$

subject to $D(r_D) = \alpha^S L^S(r_L^S) + \alpha^P L^P(r_L^P)$

i.e. maximize $\int_{\underline{r}}^{r_D} D(s)ds + \alpha^S \int_{r_L^S}^{\bar{r}} L^S(s)d(s) + \alpha^P \int_{r_L^P}^{\bar{r}} L^P(s)d(s) + (r_L^S - r_D)\alpha^S L^S + (r_L^P - r_D)\alpha^P L^P$

subject to $D(r_D) = \alpha^S L^S(r_L^S) + \alpha^P L^P(r_L^P)$

From the constraint, we get $r_D = D^{-1}(\alpha^S L^S(r_L^S) + \alpha^P L^P(r_L^P))$. Substitute this expression into the objective function and calculate the first-order conditions with respect to the loan interest rates. From $\frac{\partial \Omega}{\partial r_L^S} = 0$, we get

$$[\alpha^S L(r_L^S) + \alpha^P \theta L(r_L^P)]\frac{\alpha^S L'(r_L^S)}{D'(r_D)} - \alpha^S L(r_L^S) + [1 - \frac{\alpha^S L'(r_L^S)}{D'(r_D)}]\alpha^S L(r_L^S)$$

$$+(r_L^S - r_D)\alpha^S L'(r_L^S) - \alpha^P \theta L(r_L^P)\frac{\alpha^S L'(r_L^S)}{D'(r_D)} = 0$$

i.e.

$$(r_L^S - r_D)\alpha^S L'(r_L^S) = 0$$

therefore,

$$r_L^S = r_D$$

Similarly, from $\frac{\partial \Omega}{\partial r_L^P} = 0$, we get $r_L^P = r_D$. Hence, $r_L^S = r_L^P = r_D = r^*$. By the market clearing condition, we know the interest level satisfies $D(r^*) = \alpha^S L^S(r^*) + \alpha^P L^P(r^*) = (\alpha^S + \theta\alpha^P)L(r^*)$. ■

Proposition 5.3

Proof. The regulator's problem is to

maximize $a(W^A + W_\lambda^S + W^P + W^B) + C^S(r_D, r_L^S) + C^P(r_D, r_L^P) + C^B(r_D, r_L^S, r_L^S)$

i.e. maximize $a(V^D + \lambda V^S + V^P + V^B) + C^S(r_D, r_L^S) + C^P(r_D, r_L^P) + C^B(r_D, r_L^S, r_L^S)$

subject to $D(r_D) = \alpha^S L^S(r_L^S) + \alpha^P L^P(r_L^P)$

When deciding how much contribution to make, the SOEs, PEs, and banks follow a locally truthful contribution schedule (Grossman and Helpman, 1994). Around the optimal interest rates chosen by the regulator, for

one unit change of interest rate, SOEs, PEs, and banks will additionally contribute exactly the marginal change of values. Mathematically, for SOEs and PEs:

$$\frac{\partial W^i}{\partial r_L^i} = -\alpha^i L^i(r_L^i) = \frac{\partial C^i(r_D, r_L^i)}{\partial r_L^i}, i = S, P$$

$$\frac{\partial W^i}{\partial r_D} = \alpha^i D(r_D) = \frac{\partial C^i(r_D, r_L^i)}{\partial r_D} i = S, P$$

For banks:

$$\frac{\partial W^B}{\partial r} = \frac{\partial C^B}{\partial r}, r = r_D, r_L^S, r_L^S$$

Plug these seven equations into the FOCs of the regulator's objective function, and the original problem is shown to be equivalent (in the sense that they have same FOCs) to the following problem,

maximize $aV^D + (a\lambda + 1)V^S + (a+1)V^P + (a+1)V^B + (1-\alpha^A)V^D$

subject to $D(r_D) = \alpha^S L^S(r_L^S) + \alpha^P L^P(r_L^P)$

Substitute the constraint into the objective function (eliminating $r_{D)}$ and calculate two FOCs with respect to r_L^S and r_L^P. We get the following[25]:

$$a[L(r_L^S)+\theta L(r_L^P)]\frac{L'(r_L^S)}{D'(r_D)} - (a\lambda+1)L(r_L^S) + (a+1)[1-\frac{L'(r_L^S)}{D'(r_D)}]L(r_L^S) + (a+1)(r_L^S - r_D)L'(r_L^S)$$

$$-(a+1)\frac{L'(r_L^S)}{D'(r_D)}\theta L(r_L^P) + (1-\alpha^A)D(r_D)\frac{L'(r_L^S)}{D'(r_D)} = 0$$

$$a[L(r_L^S)+\theta L(r_L^P)]\frac{\theta L'(r_L^P)}{D'(r_D)} - (a+1)\theta L(r_L^P) + (a+1)[1-\frac{\theta L'(r_L^P)}{D'(r_D)}]\theta L(r_L^P) + (a+1)(r_L^P - r_D)\theta L'(r_L^P)$$

$$-(a+1)\frac{L'(r_L^S)}{D'(r_D)}\theta L(r_L^S) + (1-\alpha^A)D(r_D)\frac{\theta L'(r_L^P)}{D'(r_D)} = 0$$

After simplification, we get (5.12) and (5.13). ■

Case 3 of Proposition 5.3

Proof. The regulator's problem is

maximize $a(W^A + W_\lambda^S + W^P + W^B) + C^S(r_D, r_L^S) + C^B(r_D, r_L^S, r_L^S)$

i.e. maximize $a(V^D + \lambda V^S + V^P + V^B) + C^S(r_D, r_L^S) + C^B(r_D, r_L^S, r_L^S)$

subject to $D(r_D) = \alpha^S L^S(r_L^S) + \alpha^P L^P(r_L^P)$

Following the similar logic of the proof of proposition 5.3, plug SOEs and banks' truth-telling conditions into the FOCs of the regulator's objective

[25] Note that α^S appear in every term of FOC, thus it doesn't appear in the final result. The same thing holds for α^P.

function, and the original problem is shown to be equivalent to the following problem in terms of FOCs:

maximize $aV^D + (a\lambda + 1)V^S + aV^P + (a+1)V^B + (1-\alpha^A-\alpha^P)V^D$

subject to $D(r_D) = \alpha^S L^S(r_L^S) + \alpha^P L^P(r_L^P)$

Substitute the constraint into the objective function (eliminating r_D) and calculate two FOCs with respect to r_L^S and r_L^P. We get the following:

$$a[L(r_L^S)+\theta L(r_L^P)]\frac{L'(r_L^S)}{D'(r_D)}-(a\lambda+1)L(r_L^S)+(a+1)[1-\frac{L'(r_L^S)}{D'(r_D)}]L(r_L^S)+(a+1)(r_L^S-r_D)L'(r_L^S)$$

$$-(a+1)\frac{L'(r_L^S)}{D'(r_D)}\theta L(r_L^P) + (1-\alpha^A-\alpha^P)D(r_D)\frac{L'(r_L^S)}{D'(r_D)} = 0$$

$$a[L(r_L^S)+\theta L(r_L^P)]\frac{\theta L'(r_L^P)}{D'(r_D)}-a\theta L(r_L^P)+(a+1)[1-\frac{\theta L'(r_L^P)}{D'(r_D)}]\theta L(r_L^P)+(a+1)(r_L^P-r_D)\theta L'(r_L^P)$$

$$-(a+1)\frac{L'(r_L^S)}{D'(r_D)}\theta L(r_L^S) + (1-\alpha^A-\alpha^P)D(r_D)\frac{\theta L'(r_L^P)}{D'(r_D)} = 0$$

After simplification, we get (5.15) and (5.16). ■

Proposition 5.4

Proof. maximize $\Omega(r_D, r_L^S, r_L^P) = W^A + W^S + W^P + W^B + T = V^D + V^S + V^P + V^B + T$

i.e. maximize $\int_{\underline{r}}^{r_D} D(s)ds + \int_{r_L^S}^{\bar{r}} L^S(s)d(s) + \int_{r_L^P}^{\bar{r}} L^P(s)d(s) + (r_L^S - r^{**})L^S(r_L^S) + (r_L^P - r^{**})L^P(r_L^P) + (r^{**} - r_D)D(r_D)$[26]

FOCs with respect to r_L^S, r_L^P,and r_D result $r_D = r_L^S = r_L^P = r^{**}$.. ■

Proposition 5.5

Proof. The regulator's problem is

maximize $a(V^D + \lambda V^S + V^P + V^B + T) + C^S(r_D, r_L^S) + C^P(r_D, r_L^P) + C^B(r_D, r_L^S, r_L^S)$

Following the similar logic of the proof of proposition 5.3, plug SOEs, PEs, and banks' truth-telling conditions into the FOCs of the regulator's objective function, and the original problem is equivalent to the following problem in terms of FOCs:

maximize $aV^D + (a\lambda+1)V^S + (a+1)V^P + (a+1)V^B + aT + (1-\alpha^A)V^D$

Plug in (5.17) and (5.18) and calculate three FOCs with respect tor_D, r_L^S and r_L^P. We get the following:

$$\frac{(a+1)(r_L^P - r_D) + a(r^{**} - r_L^P)}{r_D} = \frac{\alpha^A}{\varepsilon_D}$$

[26]It is easy to prove that in either capital inflow or capital outflow case the summation of V^B and T is $(r_L^S - r^{**})L^S(r_L^S) + (r_L^P - r^{**})L^P(r_L^P) + (r^{**} - r_D)D(r_D)$

$$\frac{(a+1)(r_L^S - r_L^P) + a(r_L^P - r^{**})}{r_L^S} = \frac{(1-\lambda)a}{\varepsilon_L^S}$$

$$\frac{a(r_L^P - r^{**})}{r_L^P} = \frac{k}{\varepsilon_L^P}$$

After simplification, we get

$$r_L^P = r^{**} - \frac{k\alpha^P L(r_L^P)}{-aL'(r_L^P)}$$

$$r_L^S = r^{**} - \frac{1}{a+1}[\frac{k\alpha^P L(r_L^P)}{-aL'(r_L^P)} + \frac{(\lambda-1)a\alpha^S L(r_L^S)}{-L'(r_L^S)}]$$

$$r_D = r^{**} - \frac{1}{a+1}[\frac{k\alpha^P L(r_L^P)}{-aL'(r_L^P)} + \frac{\alpha^A D(r_D)}{D'(r_D)}]$$

So do $\frac{r_L^P - r^{**}}{r_L^P}$, $\frac{r_L^P - r_D}{r_D}$, and $\frac{r_L^S - r_D}{r_D}$. ■

Proposition 5.6

Proof. Again, by plugging in the SOEs, PEs, and banks' locally truthful contribution schedules into the FOCs of the regulator, we get a equivalence problem in terms of FOCs as follows,

maximize $aV^D + (a\lambda+1)V^S + (a+1)V^P + (a+1)V^B + aT + (1-\alpha^A)V^D$

Plug in the expressions (5.19)and (5.20) and calculate three FOCs with respect to r_D, r_L^S and r_L^P. We get the following:

$$D(r_D) - \alpha^S L(r_L^S) - \theta\alpha^P L(r_L^P) - \alpha^A D(r_D) + a(r^{**} - r_D)D'(r_D) = 0$$

$$(a+1)r_L^S - r_D - ar^{**} = \frac{a(\lambda-1)\alpha^S L(r_L^S)}{L'(r_L^S)}$$

$$(a+1)r_L^P - r_D - ar^{**} = 0$$

Simplifying these FOCs, we get the expression of r_D, r_L^S and r_L^P, so do the results of the proposition. ■

5B Figures

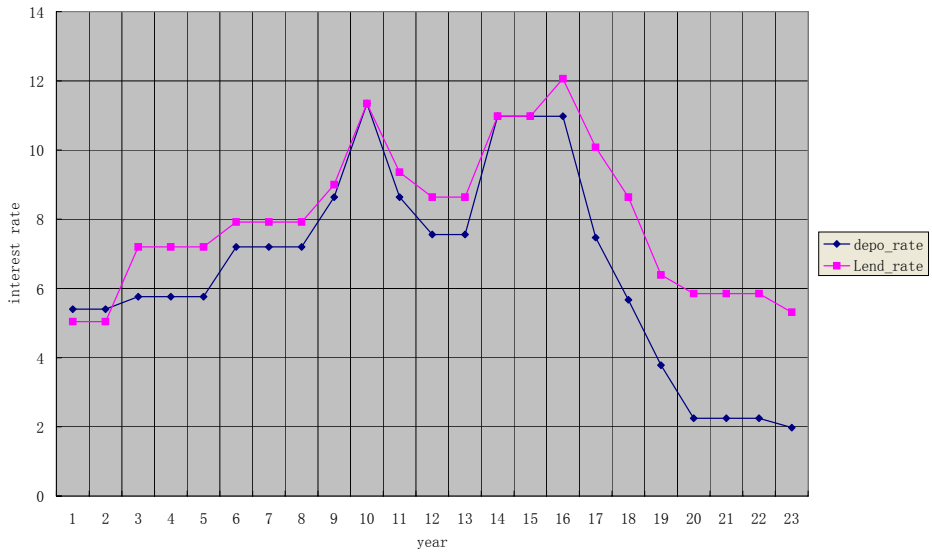

Figure 5.1.1: Norminal Interest Rates (1980-2002)

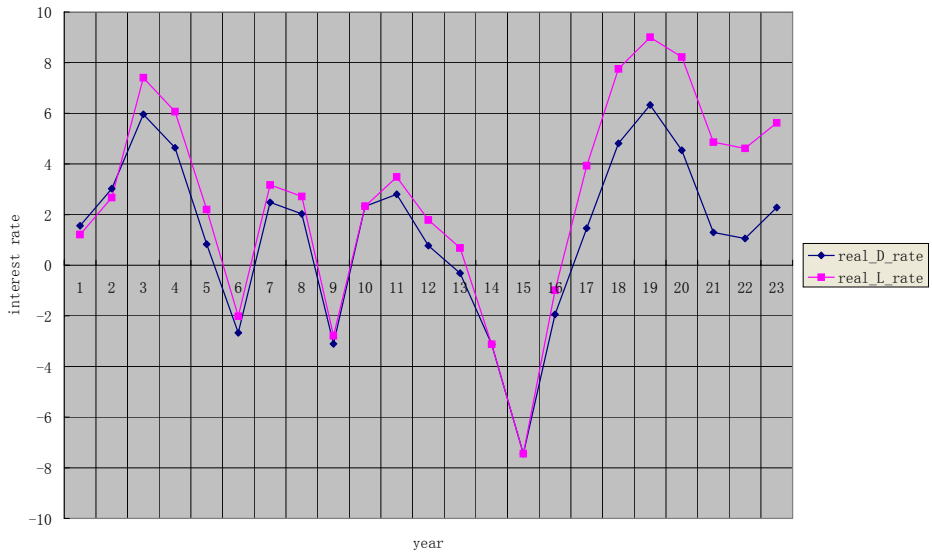

Figure 5.1.2: Real Interest Rates (1980-2002)

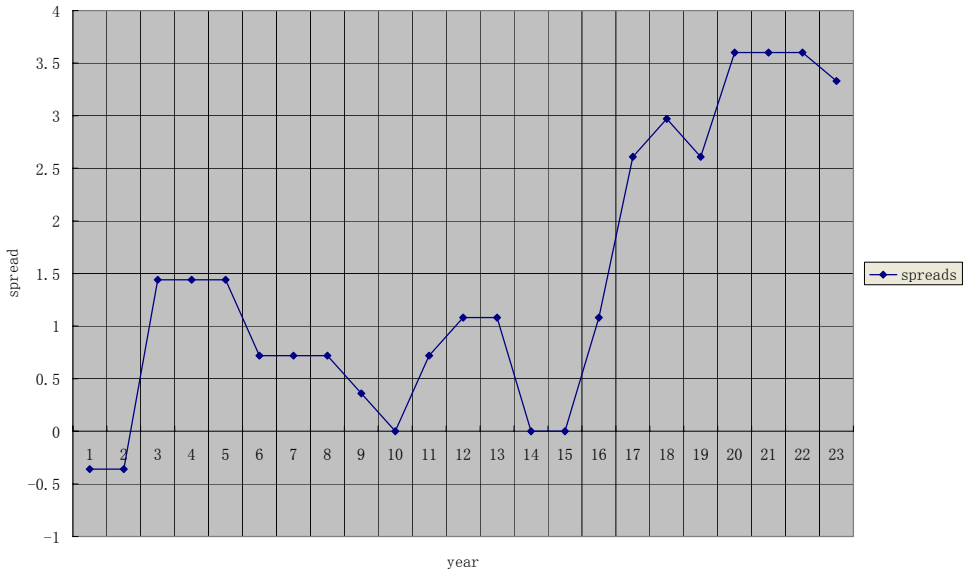

Figure 5.2: loan-deposit Interest rate spreads (1980-2002)

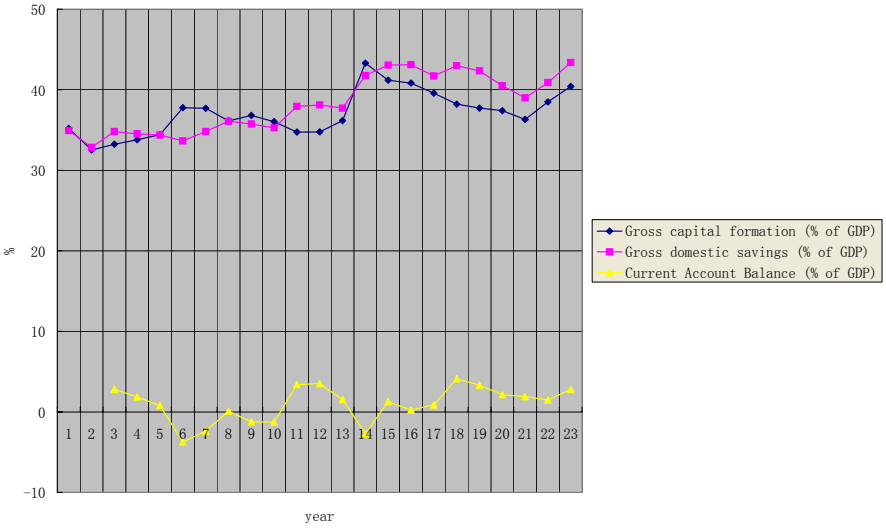

Figure 5.3: Savings, investment, and current account (1980-2002)

5C Tables

Table 5.1: Comparison of Loan-to-Deposit Ratios of State Banks: Henan, Fujian, and Zhejiang provinces, 1988-1999

Year	Henan Province	Fujian Province	Zhejiang Province
1988	1.48	1.23	1.26
1989	1.42	1.18	1.19
1990	1.36	1.07	1.05
1991	1.28	0.96	0.97
1992	1.25	0.88	0.93
1993	1.20	0.95	0.92
1994	1.16	0.90	0.90
1995	1.12	0.83	0.81
1996	1.09	0.78	0.75
1997	1.13	0.75	0.77
1998	1.14	0.79	0.73
1999	1.12	0.79	0.74

Source: Tsai, Kellee S., 2002.
Note: The national average loan-to-deposit ration is 1.0.

Table 5.2: Capital-to-output ratio of industrial state and non-state enterprises by industry in 1996

Types of enterprises	Capital-output ratio
State-owned Enterprises	1.92
Non-state enterprises	1.05
Collectively owned enterprises	0.82
Private and individual enterprises	0.99
Foreign-invested enterprises	1.25

Source: Tong (2002).

Table 5.3: Average annual growth rates, private enterprises vs. other types of enterprises in 1989-1998 (in %)

	State-owned	Collectively owned	Foreign-invested	Private
Number of enterprises	5.37	0.27	34.40	33.27
Total capital	12.89	11.56	36.49	63.97
Average capital per firm	7.64	11.86	1.89	23.04
Workforce	-0.01	-0.06	22.55	29.76
Output (in real terms)				51.86
Tax remitted	14.83	11.80		73.15

Source: Tong (2002).

Table 5.4: Quarterly data on Chinese foreign reserve and central bank bills (Sept. 2002-Dec. 2004) Unit: billion RMB

Date	09/2002	12/2002	03/2003	06/2003	09/2003
Foreign reserve	2038.2	2210.7	2406.2	2598.3	2867.0
Central Bank Bills	193.8	143.8	45.0	238.0	440.0
Date	12/2003	03/2004	06/2004	09/2004	12/2004
Foreign reserve	2984.2	3275.8	3519.8	3823.7	4594.0
Central Bank Bills	303.2	595.7	747.6	766.2	1107.9

Source: People's Bank of China website.

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Samenvatting(Summary in Dutch)

Dit proefschrift bevat vier essays waarin wordt onderzocht hoe de financiële structuur van een land invloed uitoefent op de macro-economische prestaties in termen van groei, conjunctuur en consumptie-effening. Het begrip financiële structuur is daarbij gedefinieerd als de verzameling van markten, instellingen en instrumenten, het systeem van toezicht, regelgeving en functies, en de rentestructuur. Informatieproblemen en transactiekosten leiden tot een variëteit van financiële contracten, markten en instituties, en daarmee tot een complex financieel systeem. Het staat hoog op de onderzoeksagenda van economen om een analytische basis te leggen voor het beschrijven van de voorwaarden waaronder een bepaalde financiële structuur beter kan bijdragen aan macro-economische groei en stabiliteit.

De hoofdstukken van dit proefschrift zijn min of meer onafhankelijke studies rondom deze centrale probleemstelling. Hoofdstuk twee en drie analyseren de gevolgen van schuldfinanciering versus aandelenfinanciering voor de stabilisatie van de consumptie respectievelijk de productie. In de literatuur worden deze verbanden weinig onderzocht. Hoofdstuk vier evalueert de rol van informele financiële instituties tegen de achtergrond van het feit dat deze dominant aanwezig zijn in ontwikkelingslanden en dat het beleid ter zake vaak een ambivalente houding aanneemt. Nagegaan wordt hoe de gelijktijdige aanwezigheid van formele en informele instituties, binnen de context van een ongelijke maatschappij met een imperfecte kredietmarkt, van invloed is op de groei. Hoofdstuk vijf gaat in op het vraagstuk van de rentevorming in een transitieland. De beleidsmaker wordt geleid door een eigen ideologische voorkeur alsmede door de pressie van een aantal belangengroeperingen. Het model beziet hoe een politiek verwrongen rentevoet gevolgen heeft voor de economische efficiëntie onder omstandigheden die relevant zijn voor landen in transitie.

Elk van de vier hoofdstukken van dit proefschrift bevat zowel een theoretisch als een empirisch deel, waarbij het relatieve gewicht van beiden

varieert. De empirische methode is voor elk hoofdstuk verschillend. Hoofdstuk twee en drie presenteren dwarsdoorsneden over landen. Hoofdstuk 4 bevat een dwarsdoorsnede over de provincies van één land. Hoofdstuk vijf is een gedocumenteerde landenstudie. De keuze van het in de hoofdstukken vier en vijf bestudeerde land, China, is theoretisch aantrekkelijk, maar gaat ook terug op de eigen achtergrond en bekendheid van de auteur.

Hoofdstuk 2 introduceert proxie-variabelen voor zowel de binnenlandse ontwikkeling als de internationale integratie van de schuld- en aandelenmarkten. Op deze manier kan een aantal conclusies worden getrokken over de betekenis van de financiële structuur voor de consumptie-effening. In de eerste plaats blijken zowel de binnenlandse ontwikkeling als de internationale integratie van belang. In de tweede plaats blijkt voor rijke landen de ontwikkeling van de binnenlandse markt voor schuldtitels relatief belangrijk, terwijl voor arme landen juist de internationale integratiegraad bepalend is. In de derde plaats draagt de ontwikkeling van zowel de markt voor schuldtitels als de markt voor eigendomsbewijzen bij aan de consumptie-effening, met een iets sterkere rol voor eerstgenoemde. En tenslotte zijn de schulden aandelenmarkt tot op zekere hoogte substitueerbare instrumenten bij het realiseren van consumptie-effening.

Hoofdstuk 3 laat aan de hand van een eenvoudig model zien hoe de financiële structuur verantwoordelijk kan zijn voor macro-economische fluctuaties en recessies. Bij het zoeken naar een optimale vermogensstructuur wordt de ondernemer geconfronteerd met een afruil. Schuldfinanciering is goedkoper dan aandelenfinanciering omdat het minder verificatie vergt, maar daar staat tegenover dat schuldfinanciering de kans op een kostbaar faillissement verhoogt. Op geaggregeerd niveau leidt een bepaalde negatieve schok in een bankgeoriënteerde systeem tot meer faillissementen en een scherpere neergang in de productie dan in een marktgeoriënteerd systeem. Ook de variantie van de productie is groter in een economie met een relatief omvangrijke kredietmarkt. Aan de hand van een uitgebreide internationale dataset kan deze hypothese empirisch worden gesteund.

In hoofdstuk 4 wordt een ruraal-specifiek model geconstrueerd waarmee de invloed van de inkomensongelijkheid op de groei kan worden onderzocht onder omstandigheden van moreel laakbaar gedrag in de kredietmarkt. Banken vertrouwen op onderpand terwijl informele instellingen hun kredietnemers direct volgen, en daarbij kosten maken. Aangezien beide kanalen onaantrekkelijk zijn voor een bepaald segment van de markt, leidt hun gezamenlijke aanwezigheid tot een verhoging van de groei. Een dwarsdoorsnede analyse van provinciale data in ruraal China laat een negatieve relatie zien tussen ongelijkheid en groei. Een nadere modeltest bevestigt dat een positieve houding

tegenover informele instituties de groei bevordert.

Het fundament van hoofdstuk 5 is een politiek-economische benadering van de rentevorming in een transitieland. Het model geeft een positieve verklaring voor het verschijnsel dat de rente duurzaam kan afwijken van het binnenlandse evenwichtsniveau, dan wel van het buitenlandse niveau in een open economie. Aangetoond wordt dat de afwijking het gevolg is van een beleidsmaker met een ideologische voorkeur die onder druk van een pressiegroep zijn sociale welvaartsfunctie maximaliseert. Het model levert nuttige inzichten ter verklaring van de onderdrukking van de rentevoet, de grootte van de rentemarge, de sectorspecifieke afwijking in de kredietallocatie, en de snelheid en volgorde van het renteliberaliseringsbeleid. Toepassing van het model op China bevestigt dat het proces van renteliberalisering is vertraagd door de aanwezigheid van belangengroepen en van een ideologische voorkeur bij de autoriteiten. Dynamische veranderingen in de kenmerken van de belangengroep en de aard van de gehanteerde ideologie, samen met het gedeeltelijk openbreken van het Chinese financiële systeem, ondermijnen het bestaande politieke evenwicht en maken de recente versnelling in het renteliberaliseringsbeleid begrijpelijk.

Gezamenlijk genomen proberen de essays in dit proefschrift een dieper inzicht te geven in de krachten achter de vormgeving en de dynamiek van de financiële structuur. Tevens willen zij het theoretisch onderzoek ter zake verruimen in de richting van de relatie met de macro-economische ontwikkeling, in het bijzonder de economische groei, de conjunctuur en de consumptie. Door een aantal praktische boodschappen te geven verschaft het proefschrift bovendien enkele aangrijpingspunten voor het financiële structuurbeleid.